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COMMONWEALTH OF MASSACHUSETTS

SUMMARY OF WATER QUALITY

1978

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DIVISION OF WATER POLLUTION CONTROL

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COMMONWEALTH OF MASSACHUSETTS

SUMMARY OF WATER QUALITY

1978

Prepared By
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Massachusetts Division of Water Pollution Control

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FOREWORD

The 1972 Federal Water Pollution Control Act Amendments (Public Law 92-500) set very stringent national water quality goals. Foremost of these is that by 1983 we have, wherever attainable, a water quality which is safe for swimming and which will protect fish and wildlife. Congress recognized that to achieve these ambitious goals, broader and more preventive steps must be taken in the field of water pollution control, and a systematic approach of documenting progress toward these goals must be established. Different sections of the Act, therefore, required specific water pollution control programs, as well as various types of water quality reporting on these activities.

Section 305(b) of the Federal Act requires each state to prepare an annual State Water Quality Inventory Report. This report, which has become known as the "305(b) Report," consolidates the various water quality reporting activities into one clear and concise summary. It produces a single assessment of the state's water quality based on the best available information. This assessment can be used by citizen groups as well as local, state, and federal governmental agencies to evaluate the effectiveness of water pollution control programs. It also provides a consistent view of changing water quality throughout the state. For Massachusetts, in particular, the 305(b) report consolidates the water quality reporting activities of the state's Section 303 water quality management planning, Section 208 areawide wastewater management studies, and Section 314, clean lakes inventory.

303(e) Basin Plans

In addition to Section 303(e) of the Federal Act, water quality management plans are required by the Massachusetts Clean Waters Act (General Laws, Chapter 21). The purpose of such plans is to establish a cost effective and environmentally sound program of pollution abatement for the waters of the Commonwealth. The goals of the Water Quality Management Plans are set by the state's Water Quality Standards. These standards consist of definitions of the use classification, general regulation, present and future use classifications of the waters of the Commonwealth, and plans of implementation to meet the future use classification.

The Commonwealth of Massachusetts is divided into twenty-four major drainage basins for the purpose of water quality management planning. The basins are the Massachusetts portions of the following drainage areas:

Blackstone River
Boston Harbor
Buzzards Bay
Cape Cod
Charles River
Chicopee River
Connecticut River
Deerfield River
Farmington River
French and Quinebaug Rivers
Hoosic River
Housatonic River
Ipswich and Parker Rivers
The Islands
Merrimack River
Millers River
Nashua River
North Coastal
North River
South Coastal
SuAsCo Rivers
Taunton River
Ten Mile River
Westfield River

The unique thrust of the basin plans is to develop a comprehensive regional overview of the water quality problems of the basin so that guidelines may be established for managing the area's water pollution control problems. As a result, the plan forms the basis for a number of federal and state programs, including the construction grants program and the discharge permit program. The basin plan also sets forth a program of water quality monitoring to document progress towards reaching the goals of the plan and to locate any additional problems.

208 Areawide Wastewater Management Plans

Section 208 of the Act is the intended vehicle for developing a comprehensive regional water quality management plan which will simultaneously address lake management, groundwater protection, storm runoff, non-structural alternatives, the impacts of land use decisions on water quality, municipal facilities, industrial sources, combined sewers and non-point pollution sources.

The 208 plan is designed to produce clean water through the implementation of its recommendations. It addresses point sources of pollution as well as non-point sources and evaluates their combined impact on water quality.

314 Lake Classification System

The Division of Water Pollution Control has developed a lake classification system as an aid to setting priorities for the Lake Restoration Program (Section 314 of PL92-500) in Massachusetts. This system is generally applied only to those lakes for which the Division has collected water quality data. Although a host of physical, chemical, and biological parameters are measured during the normal lake survey, only six critical parameters are employed in the lake classification priority system. The six parameters are: hypolimnetic dissolved oxygen, secchi disc reading, phytoplankton count, total ammonia- and nitrate-nitrogen, total phosphorus, and aquatic macrophyton. The most recent survey data are used and the priority listing is updated annually. The optimum season for collecting lake data is mid- to late summer, or during peak biological production. Unfortunately, this cannot always be achieved; thus spring or autumnal data have to be used in the lake classification system.

The limits used for awarding severity points for the six parameters have been based on several considerations and information sources. These include lake classifications of other states, the natural range of parameters in Massachusetts, limnological texts, and accepted indices of eutrophication reported in the literature. The severity point system has been formulated as follows:

Parameter	Concentration or Degree of Severity	Points
Hypolimnetic dissolved oxygen	≥5.0 mg/l	0
	<5.0-3.0 mg/l	1
	<3.0-1.0 mg/l	2
	<1.0 mg/l	3

Parameter	Concentration or Degree of Severity	Points
Transparency (secchi disc reading)	≥15 feet	0
	<15-10 feet	1
	<10-4 feet	2
	<4 feet*	3
Phytoplankton	0-500 ASU or natural units/ml	0
	>500-1000 ASU or natural units/ml	1
	>1000-1500 ASU or natural units/ml	2
	>1500 ASU or summer "blooms"	3
Epilimnetic NH_3 + NO_3-N	0- 0.15 mg/l	0
	≥0.15-0.3 mg/l	1
	>0.3-0.5 mg/l	2
	>0.5 mg/l	3
Epilimnetic total phosphorus	0.0.01 mg/l	0
	>0.01-0.05 mg/l	1
	>0.05-0.10 mg/l	2
	>0.10 mg/l	3
Aquatic Vegetation	Sparse	0
	Medium	1
	Dense	2
	Very dense	3

It is expected that chlorophyll-a data will soon augment or replace the phytoplankton data as they become part of the routine lake survey. The severity points may be interpreted as follows:

0 = No problem. Considered to be representative of clean water quality.

1 = Slight problem; borderline case considered to be potentially degrading.

2 = Definite problem. Considered unacceptable for lake water quality.

3 = Severe problem, undoubtedly causing degradation of the lake's water quality or some recreational uses.

Lakes, ponds, and reservoirs are first divided into two major categories:

1) Those which stratify during the summer
2) Those which do not stratify during the summer

Next, severity points are assigned to each of the above critical parameters. On the basis of the severity point system, a priority listing can be maintained. This listing, in conjunction with other available data, can then be used for a

*Four feet is the minimum allowable transparency at bathing beaches, as stated in Article VII of the State Sanitary Code.

trophic level classification system. On the basis of a possible 18 severity points, the trophic level index would be as follows:

0 - 6	oligotrophic
6 - 12	mesotrophic
12 - 18	eutrophic

The overlap of severity points is intentional and meant to underscore the system's flexibility. The general range of severity points is considered more important than the absolute total for a given lake.

Although the system is not 100% equitable, it does appear to give a fair representation of lake trophic conditions for the vast majority of Massachusetts' lakes. River impoundments below point waste discharges present special cases. Personal knowledge of these situations helps explain anomalies in the data. By its very nature, the system cannot be static, but will be under constant evaluation as new data become available.

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INTRODUCTION

The following 305(b) report presents a basin-by-basin summary of the existing stream and lake classifications, present water quality, and the water quality problems of the main streams and coastal zones of the Commonwealth based on the most up-to-date information presently available.

The report is divided into twenty-five sections. One section is devoted to each of the state's twenty-four drainage areas, while the last section contains a summary of the present water quality of all the major streams and coastal segments within the Commonwealth. Each of the sections devoted to a particular drainage area contains a description of that drainage area, a description of the latest water quality surveys performed within the basin, a listing of the segmentation, classification and present condition of major streams and/or coastal zones of the basin, an inventory of the area's lakes and ponds, a description of the lake surveys conducted, and the classifications of the area's lakes and ponds.

It should be noted that this report only summarizes various publications. The reader should refer to the latest publications of a particular basin for more complete details. There are a number of reports available for each basin. The Division of Water Pollution Control, for instance, publishes a series of reports on water quality for the various river basins within the state. These include reports of data obtained from intensive water quality surveys, which have become known as Part A's; reports of waste discharge data which have become known as Part B's; reports to present a written and graphic analysis of the data, together with historical, hydrologic, and socio-economic information relating to water quality, Part C's; and Water Quality Management Plans, Part D's. In addition to the above, numerous other reports are also available, including various reports on Water Quality Studies of Selected Lakes and Ponds which are prepared by the Division, as well as Areawide Wastewater Management (208) Plans prepared by regional planning agencies.

This report draws most of its information from the individual Water Quality Management Plans for each basin. These plans present long-range solutions to water quality problems and contain detailed data and analysis employed to formulate the solutions. The goals of the Water Quality Management Plans are set by the appropriate Water Quality Standards. The present Massachusetts Water Quality Standards were established by the Division in 1967 and revised in 1974. These standards consist of definitions of the use classifications, general regulations, present and future use classifications of the waters of the Commonwealth, and plans of implementation to meet future use classifications. A summary of these present standards can be found in Appendix I.

It should be noted that the water quality standards are presently being revised. Under these revisions, the present classifications of most segments will be maintained and/or upgraded in accordance with the 1983 goal of PL92-500. This goal calls for waters suitable for contact recreation and fish and wildlife propagation (often abbreviated as "swimmable/fishable waters"). Since this document reports the quality of the water of the Commonwealth as of January 1, 1978, the classifications described in this report do not reflect these upgradings.

The national goal established by the federal law for the attainment of swimmable/fishable water quality by 1983 would mean water quality essentially equivalent to Class B under the Massachusetts Standards. It should be emphasized that attainment of this water quality is still a goal and not a legal requirement, at least until such time as the proposed revisions to the standards become adopted. Statewide studies are underway to estimate the cost of reaching this goal, as well as to evaluate critical areas within the state which are not expected to meet Class B quality by 1983. The results of these studies will be prescribed in Phase II Water Quality Management Plans as well as being incorporated in future 305(b) reports.

It is recognized that certain waters of the Commonwealth possess an existing quality which is better than the criteria assigned to them by the standards. These segments are protected by anti-degradation provisions under regulation III of the Massachusetts Water Quality Standards. A listing of these segments can be found in Appendix II.

Several references to non-point sources of pollution have been made in this report. These sources are defined as those which do not discharge continuously through a pipe or similar conduit to a receiving water. Such pollution sources are not amenable to the traditional abatement techniques of sewers and treatment plants. Non-point sources include urban and agricultural runoff, seepage from dumps and mining operations, and malfunctioning subsurface disposal facilities. Control measures for non-point sources could include land use zoning or more stringent operation and maintenance procedures. Such measures are being studied under Section 208 Areawide Wastewater Management Plans. Since many of the 208 reports are still incomplete, this report only briefly assesses the impact of non-point sources on water quality. Future 305(b) reports will contain more complete inventories and assessments of these pollutant sources.

The Division is presently evaluating an index of water quality for inhouse use and as a method of communicating complex water quality information to the general public. The index under consideration was developed for the National Sanitation Foundation by Brown et al (1970) and has become the most widely-used "general water quality index" available (Ott, 1978). The need for a uniform index of water quality has been recognized for many years. By providing an unbiased method for comparing conditions between locations and changes occurring over a period of time, management decisions can be made and the success of programs can be evaluated.

The NSF water quality index has been determined for selected river basins sampled during 1977 and is reported in Appendix II. The index (WQI) uses nine parameters: dissolved oxygen, fecal coliform, pH, biochemical oxygen demand, nitrates, total phosphorus, temperature deviation, turbidity, and total solids. Each parameter, as well as the index itself, is represented on a 100-point scale; higher values indicating better water quality. This classification may be evaluated as follows:

>80 - Excellent
65- 80 - Good
50- 65 - Fair
25- 50 - Poor
<25 - Very Poor

Appendix III also highlights those parameters which fall below 65 (*<50, **<25) and gives the actual quality rating for each. It should be noted that fecal coliform was modified so that 1000/100 ml would obtain a value of 50, while 200/100 ml would be judged 65. This change was made based on present water quality standards.

While this present report does not utilize the NSF water quality index for evaluating the present water quality, its use is anticipated for future 305(b) publications. The present water quality of the main streams and coastal zones were evaluated (for purposes of this report) by a number of different individuals. Because this evaluation is based on the discretion of the person performing the analysis, the descriptions of the existing condition are not entirely constant throughout the report. It is hoped that use of the NSF water quality index will create more continuity in future reports.

I - THE BLACKSTONE RIVER BASIN

The Blackstone River is an interstate stream, originating in Worcester, Massachusetts, and flowing southeast some fifty miles to Providence, Rhode Island, where it forms the headwaters of Narragansett Bay. Major tributaries in Massachusetts include Kettle Brook in Worcester, the Quinsigamond River in Grafton, the Mumford and West Rivers in Uxbridge, and the Mill River which joins the Blackstone just below the state line in Woonsocket, Rhode Island. The Massachusetts portion of the drainage basin covers approximately 328 square miles, including all or most of the City of Worcester and the towns of Auburn, Blackstone, Douglas, Grafton, Hopedale, Mendon, Millbury, Millville, Northbridge, Sutton, Upton, and Uxbridge. Major portions of Leicester, Paxton, and Shrewsbury also lie within the basin, as do small portions of Attleboro, Bellingham, Boylston, Franklin, Holden, North Attleborough, Oxford, Plainville, Webster, Westborough, West Boylston, and Wrentham. Adjacent drainage basins to the Blackstone in Massachusetts are the French and Quinebaug to the west, the Chicopee to the northwest, the Nashua to the north, the Concord to the northeast, the Charles to the east, and the Ten Mile to the southeast.

Water quality in the Blackstone River is now degraded to the extent that it is unfit for any recreational or industrial use (other than power generation). Portions of the Mumford and Mill Rivers are similarly degraded. Many of the tributary streams, however, support various uses. Public water supply for the City of Worcester is provided by reservoirs on Kettle and Tatnuck Brooks. Numerous streams throughout the basin support sport fisheries. Lakes and ponds in the basin--notably Lake Quinsigamond, Dorothy Pond, Singletary Pond, and Manchaug Pond, provide opportunities for fishing, boating, and swimming. As demands for water supply and water-related recreation continue to increase, the quality of the water resources in the basin will grow in importance. Major steps are being taken to abate existing water pollution and prevent future pollution problems.

Water Quality Surveys

Intensive water quality surveys on the Blackstone River have been conducted by the Division of Water Pollution Control in 1973 and 1977. The 1977 surveys entailed more than 70 stations. These surveys were set up to evaluate non-point as well as point sources of pollutants. Numerous stations on small tributary streams were also added for this purpose. The results of the 1977 survey will be the basis of a major updating of the Blackstone River Water Quality Management Plan.

Results of the water quality have been published by the Division in The Blackstone River Part A, 1973 Water Quality Data and The Blackstone River Part A, 1977 Water Quality Data.

All major waste discharges in the Blackstone Basin were sampled from 1973 to the present. The most recent data can be found in a report titled The Blackstone River Part B, 1977 Wastewater Discharge Data.

Basin Segmentation

In order to define the present problems, the major streams of the basin have been broken down into a number of segments. These segments are listed in Table 1.

Along the main stem Blackstone River, a segment division occurs at each classification change, at each municipal wastewater treatment facility, and at the confluence with each major tributary. The segmentation of Kettle Brook follows the changes in classification, while the Mumford River is divided into two segments at the site of the Douglas Sewage Treatment Plant. The other major tributaries each comprise one segment.

Table 1 also lists the present condition and future use classification. The future use classification is based on the present water quality standards, while the present condition is based on the results of the 1977 water quality surveys.

Present Condition

Segment 1 - Kettle Brook Reservoirs - The four reservoirs and their tributaries are classified anti-degradation due to their use as public water supply by the City of Worcester. No known water quality problems exist on the reservoirs.

Segment 2 - Kettle Brook from last reservoir to Waite Pond outlet - Results of the 1977 survey indicated no major problems.

Segment 3 - Kettle Brook from Waite Pond outlet to Curtis Pond outlet - Problems include slight D.O., chlorides and color violations caused by the discharge from Worcester Spinning and Finishing. Other problems include coliform violations in the Cherry Valley section of Leicester and turbidity during high flow periods caused by urban runoff.

Segment 4 - Middle River from Curtis Pond outlet to American Steel Dam - Slight coliform, D.O., and moderate turbidity problems attributable to urban runoff.

Segment 5 - Blackstone River from American Steel Dam to Upper Blackstone Sewage Treatment Plant outfall - Severe coliform, D.O. and solids problems, and moderate nutrient problems caused by combined sewer overflows to Mill Brook Canal, an underground stream which enters at the head of the segment. Occasional oil slicks result from these discharges.

Segment 6 - Blackstone River from Upper Blackstone Sewage Treatment Plant outfall to Millbury STP outfall - The problems in Segment 5 are compounded by the discharge from the treatment plant.

Segment 7 - Blackstone River from Millbury STP outfall to Fisherville Pond Problems from the previous segment continue. During the 1977 surveys the D.O. improved slightly, with the exception of a slight sag behind Singing Dam. Increase in coliform below Snider Brothers Beef; negligible impact from Millbury STP.

Segment 8 - Blackstone River from Fisherville Pond to Farnumsville Pond outlet (Grafton STP site) - Coliform, solids and nutrient problems continue. D.O. has increased at the start of the segment, but is severly depressed mid way through the segment due to the nitrification of the Upper Blackstone WTP effluent.

Segment 9 - Blackstone River from Farnumsville Pond outlet to Northbridge STP outfall - D.O. problem rated severe as nitrification continued. The BOD_5 decreased substantially from previous segment. Because of nitrification the ammonia decreased and nitrates increased. Total phosphorus also decreased.

Segment 10 - Blackstone River from Northbridge outfall to Mumford River - Coliform and nutrient problems continue to decrease. Carbonaceous demand from the Worcester discharges is satisfied; nitrification still dominates in this section and Ammonia concentrations fall to 10 mg/1. The concentration of algae begins to increase.

Segment 11 - Blackstone River from Mumford River to West River (Uxbridge STP site) - Slight increase in BOD_5, solids and color caused by Stanley Woolen Co. discharge to the Blackstone. Algae concentrations continue to increase.

Segment 12 - Blackstone River from West River to state line - D.O. and solids improve through this segment; Class C,D.O. criteria are met. Appearance of the stream has improved; however there is still a moderate nutrient problem. Algal problems begin to level off.

Segment 13 - Quinsigamond River above Irish Dam - This segment consists mainly of Lake Quinsigamond and meets classification. Occasional problems are caused by urban runoff.

Segment 14 - Quinsigamond River - Slight nutrient problems were observed on Hovey Pond below Wyman Gordon Company. Below Hovey Pond a moderate coliform problem developed due to individual sewage discharges; these discharges also contribute to the nutrient problem causing heavy algae and weed growths in Lake Ripple. Below Lake Ripple the river improves to meet Class B criteria before joining the Blackstone River.

Segment 15 - Mumford River above East Douglas - Very slight coliform and nutrient problems in the Manchaug section of Sutton. Otherwise, Class B criteria were exceeded throughout this section.

Segment 16 - Mumford River from East Douglas to Blackstone River - Slight coliform violation in East Douglas center caused by remaining individual discharges. Slight to moderate D.O. and solids problems and moderate nutrient problems below Hayward-Schuster Woolen discharge. Untreated sewage from North Uxbridge and Uxbridge center affect the lower three miles with slight nutrient and coliform problems.

Segment 17 - West River - Class B criteria are essentially met throughout. Slight D.O., nutrient problems observed in swampy area at the headwaters and below several farms in Uxbridge. No discernible effects from the Upton Sewage Treatment Plant.

Segment 18 - Mill River - Severe coliform, D.O., solids, and nutrient problems observed for about one mile below the Hopedale Sewage Treatment Plant. Below that point, problems gradually decrease to slight. Some evidence of non-point contributions from gravel pits in Hopedale, farms in Mendon, and malfunctioning septic tanks in Blackstone.

Segment 19 - Peters River - Very slight coliform and nutrient problems originating from non-point sources. All other Class B criteria are met.

Segment 20 - Beaver Brook - Much of this stream flows under the Elm Park section of Worcester. Samples collected near the mouth indicate moderate coliform, solids problems, and slight D.O., and nutrient problems. Occasional evidence of oil and metals. All of these are due to storm drains with possible illegal connections.

Segment 21 - Mill Brook - The upper portion, including Weasel Brook, is subject to urban runoff and several small, treated discharges. From Salisbury Pond to the Blackstone River, Mill Brook is an underground stream which receives combined sewer overflows and direct waste discharges. This portion is treated as a point discharge to the Blackstone River in the comparison of water quality impacts of the waste discharges. Insufficient data exists to fully evaluate the upper portion.

Segment 22 - Tatnuck Brook - Holden Reservoirs - This portion of the watershed is completely controlled by the City of Worcester for water supply; there are no known problems.

Segment 23 - Tatnuck Brook from outlet Holden Reservoir No. 2 to confluence Beaver Brook - Slight coliform and nutrient problems during high runoff periods; otherwise, Class B criteria are satisfied.

Segment 24 - Dark Brook - No known problems on upstream sections. Sampling station on lower section indicated no major problems.

Segment 25 - Ramshorn Brook - No major problems; slight increase in BOD_5, solids, nutrients and chlorides below Auburn Mall.

Segment 26 - Singletary Brook - Problems with nutrients and coliform in lower section due to malfunctioning septic systems.

Segment 27 - Dorothy Brook - Reports of non-point problems near Millbury landfill. Slight to moderate coliform problems in last one-half mile of section caused by malfunctioning septic systems.

Segment 28 - Cold Spring Brook - Meets Class B criteria.

Segment 29 - Emerson Brook - Meets Class B criteria.

Segment 30 - Bacon Brook - Meets Class B criteria.

Segment 31 - Bummet Brook - High total coliform values due to drainage area; however, fecal coliforms are at acceptable levels. Low D.O. caused by natural conditions.

Segment 32 - Axtell Brook - Meets Class B criteria.

Segment 33 - Fox Brook above Lincoln St., Blackstone - Low D.O. caused by natural conditions.

Segment 34 - Fox Brook Lincoln St. to Blackstone River - Lower portion of segment affected by individual discharges or malfunctioning septic tanks, causing nutrient and coliform violations. Low D.O. attributed mainly to natural conditions.

Segment 35 - Quick Stream - Meets Class B criteria.

Segment 36 - Muddy Brook - Meets Class B criteria.

LAKES AND PONDS

The first intensive lake study conducted by the Division was the 1971 Lake Quinsigamond study. The recommendations of that study are discussed in The Lake Quinsigamond Study 1971.

Baseline studies were conducted on twenty lakes and ponds within the Basin. These data are unpublished as of this date.

Inventory

Blackstone River Basin

Number of Lakes and Ponds	183
Surface area of Lakes and Ponds (in acres)	6,993
Number of Lakes and Ponds greater than 10 acres	107
Surface area of Lakes and Ponds greater than 10 acres	6,615
Number of officially recognized Great Ponds	8
Surface area of officially recognized Great Ponds (in acres)	2,060

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Indian Lake	Worcester	9	S
Lake Quinsigamond	Shrewsbury/Worcester	9	S
Nipmuc Pond	Mendon	6	S
Singletary Pond	Millbury/Sutton	5	S
Manchaug Pond	Douglas/Sutton	3	S
Ramshorn Pond	Millbury/Sutton	3	S
Wallum Lake	Douglas/Burrillville, R.I.	2	S
Lackey Pond	Sutton/Uxbridge	12	U
Jordan Pond	Shrewsbury	11	U
Pondville Pond	Auburn/Millbury	11	U
Coes Reservoir	Worcester	10	U
Salisbury Pond	Worcester	10	U
Cook Pond	Worcester	9	U
Dorothy Pond	Millbury	9	U

Name	Location	Severity Points	Stratified Unstratified
Crystal Lake	Douglas	8	U
Eddy Pond	Auburn	8	U
Flint Pond (So.)	Grafton/Shrewsbury	7	U
Green Hill Pond	Worcester	7	U
Flint Pond (No.)	Shrewsbury/Worcester	5	U
Stoneville Reservoir	Auburn	5	U
Waite Pond	Leicester	5	U

TABLE 1

BLACKSTONE RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSI-FICATION
1	Kettle Brook	Kettle Brook Reservoirs	Above 61.0	5.0	A	A
2	Kettle Brook	From last reservoir to Waite Pond outlet	61.0-59.3	1.7	B	B
3	Kettle Brook	From Waite Pond outlet to Curtis Pond outlet	59.3-51.3	8.0	U	C
4	Middle River	From Curtis Pond outlet to American Steel Dam	51.3-48.8	2.5	U	C
5	Blackstone River	From American Steel Dam to Worcester STP	48.8-46.6	2.2	U	C
6	Blackstone River	From Worcester STP to Millbury STP	46.6-42.8	3.8	U	C1
7	Blackstone River	From Millbury STP to Fisherville Pond	42.8-40.0	2.8	U	C1
8	Blackstone River	From Fisherville Pond to Grafton STP	40.0-38.8	1.2	U	C
9	Blackstone River	From Grafton STP to Northbridge STP	38.8-32.4	6.4	U	C
10	Blackstone River	Northbridge STP to Mumford River	32.4-29.5	2.9	U	C
11	Blackstone River	Mumford River to West River	29.5-28.7	0.8	U	C
12	Blackstone River	West River to state line	28.7-20.0	8.7	U	C
13	Quinsigamond River	Above Irish Dam	13.6-5.3	8.3	B	B
14	Quinsigamond River	Irish Dam to Blackstone River	5.3-0.0	5.3	C	B
15	Mumford River	Above East Douglas	above 9.0	5.5	B	B
16	Mumford River	East Douglas to Blackstone River	9.0-0.0	9.0	C	B
17	West River	Entire length	16.0-0.0	16.0	B	B
18	Mill River	Entire length	11.0-0.0	11.0	C	B
19	Peters River	Entire length	---	7.5	B	B

TABLE 1 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSI-FICATION
20	Beaver Brook	Entire length	--	2.0	U	B
21	Mill Brook	Entire length (including Weasel Brook)	--	4.5	U	B
22	Tatnuck Brook	Holden Reservoirs	7.6-2.1	5.5	A	A
23	Tatnuck Brook	Outlet Holden Reservoir No. 2 to confluence Beaver Brook	2.1-0.0	2.1	U	B
24	Dark Brook	Entire length	5.3-0.0	5.3	B	B
25	Ramshorn Brook	Entire length	11.2-0.0	11.2	B	B
26	Singletary Brook	Entire length	9.2-0.0	9.2	U	B
27	Dorothy Brook	Entire length	6.2-0.0	6.2	U	B
28	Cold Spring Brook	Entire length	5.5-0.0	5.5	B	B
29	Emerson Brook	Entire length	13.2-0.0	13.2	B	B
30	Bacon Brook	Entire length	5.5-0.0	5.5	B	B
31	Bummet Brook	Entire length	3.2-0.0	3.2	B	B
32	Axtell Brook	Entire length	2.0-0.0	2.0	B	B
33	Fox Brook	Above Lincoln St.,Blackstone	5.5-1.1	4.4	B	B
34	Fox Brook	From Lincoln St. to Blackstone River	1.1-0.0	1.1	U	B
35	Quick Stream	Entire length	4.1-0.0	4.1	B	B
36	Muddy Brook	Entire length	7.4-0.0	7.4	B	B

Total Miles of Class A..... 10.5
Total Miles of Class B..... 100.8
Total Miles of Class C..... 25.3
Total Miles of Unsatisfactory Conditions. 64.5

II - BOSTON HARBOR

The Boston Harbor drainage area is comprised of the Harbor itself, the Mystic, Neponset, and the Weymouth rivers.

MYSTIC RIVER BASIN

The Mystic River is a coastal stream about twenty miles in length. It runs through a watershed characterized by a high degree of urbanization. Much of the basin is highly developed with considerable industrial and commercial activity.

The headwaters of the Mystic include the Aberjona River and Hall's Brook. Horn Pond Brook in Woburn, Mill Brook in Arlington, and Alewife Brook in Cambridge all contribute to the flows in the middle Mystic.

The Upper and Lower Mystic Lakes are found in the middle basin. They are both used for recreation on a limited basis. Nutrients supplied by the Aberjona River cause the Upper Mystic Lake to be eutrophic. Lower Mystic Lake, found to the south, is fed by Upper Mystic Lake and Mill Brook. In 1966 the Amelia Earhart Dam was built to prevent salt water intrusion into the lake. However, after completion of the dam, it was found that a layer of salt water was trapped within the lake. Currently this stratified portion is undergoing anaerobic decomposition.

The outlet of the Lower Mystic Lake is recognized as the beginning of the Mystic River. It flows in a southeasterly direction, is joined by the Malden and Chelsea rivers and discharges to Boston Harbor. Alewife Brook, it should be noted, is a major cause of pollution to the Mystic and has been referred to as an "open sewer." Combined sewer overflows, obstructions in pipes, and illicit discharges are among the prime causes.

The Mystic and Chelsea rivers support heavy shipping industries. Both rivers have had serious problems from oil spills, numerous industrial discharges, overflows in sewers, and urban runoff.

Water Quality Surveys

In 1973, the Mystic River was surveyed to determine ambient water quality. Extensive chemical and biological data was collected and reported in The Mystic River 1973 Part A Water Quality Data. Discharge surveys were also conducted in 1973 and more recently in 1977. Data from these surveys can be found in The Mystic River 1973, 1977 Part B Wastewater Discharge Surveys.

WEYMOUTH RIVER BASIN

The Weymouth Fore River drains all portions of the communities of Holbrook, Avon, Brockton, Randolph, Milton, Quincy, Braintree, and Weymouth. The river is approximately twelve miles in length. The headwaters are referred to as the Cochato River, the middle portion is called the Moatiquote River, and the lower tidal portion is known as the Weymouth Fore River. The river discharges into Hingham Bay. The area drained by the Weymouth Fore is 42.25 square miles.

In 1975, this river was surveyed by DWPC. Dissolved oxygen in the river was

fairly high--lowest average recorded concentration was 4.2 mg/l. BOD, on the other hand, was almost always low with 3.3 mg/l being the maximum 2-day average that was recorded. The Cochato River was meeting Class B criteria in 1975.

Mary Lee Brook and Glover's Brook drain portions of Randolph. It was found that coliform bacteria levels were high in these streams. These tributaries are meeting C classification. After Randolph, the river passes through a large wetland area which was not accessible to survey crews and, thus, no data exists for this section of the basin.

In Braintree, the Farm River joins the Cochato River to form the Monatiquote River. The river is generally of Class B water. The gradient of the riverbed increases rapidly and reaeration causes dissolved oxygen levels to increase.

The freshwater portion of the Monatiquote ends at a dam at Factory Hill Road. Most pollution sources to this point are storm drains from urban centers. Discharges from these carry coliform bacteria which causes a fluctuation between Class B and C waters. Tidal portions are currently Class C water, while for future uses a B classification has been assumed.

WEYMOUTH BACK RIVER

The Weymouth Back River drains an area of 26.5 square miles and includes portions of the towns of Weymouth, Hingham, Holbrook, Braintree, and Rockland. Two tributaries form the headwaters of the Weymouth Back River. They are the Old Swamp River and the Mill River. The 1975 survey revealed that the Old Swamp River met Class B criteria, and supports a suitable habitat to fish and wildlife indigenous to the area. Its small streambed precludes swimming in the river.

The Mill River flows out of Weymouth Great Pond, a principal source of water supply for the Town of Weymouth. After this pond, the river is channelized, conveyed by underground conduit to Whitman's Pond, and then rooted to the Iron Hill Dam. The stream below this point is tidal and becomes the Weymouth Back River.

Water quality in the Back River is fair and considered to be of SC standard. Shellfishing is not permitted in the tidal flats due to coliform contamination. Pollution sources include raw sewage discharges resulting from bypasses and overflows at municipal pumping stations. Also suspect are stormwater discharges from urban areas.

Water Quality Surveys

In 1975 the Weymouth River, both Fore and Back, were sampled at 18 stations. This data is listed in The Weymouth River Basin 1975 Part A Water Quality Data. This report also includes the Wastewater Discharge data which was sampled in December 1975 at nine locations.

NEPONSET RIVER BASIN

The Neponset River drains a watershed of 123 square miles. Most of the area is characterized physically by gently rolling terrain, typical of coastal zones.

More than half the area contains aquifers of glacial till. The river itself flows to Hingham Bay after traveling approximately thirty miles. It is both spring- and tributary-fed.

The East Branch is the major tributary to the main stem Neponset. Mother Brook, a man-made diversion, conveys one-third of the Charles River flow to augment low flows in the Neponset.

The basin was originally an agricultural region, but has since developed into a manufacturing, retail, and service-oriented area. Its proximity to Boston is mainly responsible for this change.

Most of the Neponset River is a fresh water stream. However, after being impounded in Milton by the Walter Baker Dam, the river becomes tidal.

Present Water Use

The main stem of the Neponset has restricted capabilities for uses other than industrial water supply and conveyance of industrial and municipal discharges. Certain sections of the river can be used for boating, such as Four Meadow Marsh. Most fishing and swimming has ceased due to degraded water quality.

Water Quality Surveys

In 1973, the Neponset River was sampled for chemical and bacteriological data. Results of this effort can be found in The Neponset River Part A DWPC 1973.

Pollution discharges were also sampled at that time and again in 1975 and 1977. Discharge data are found in The Neponset River, Wastewater Discharge Surveys Part B DWPC 1973-75, 1977.

Segmentation

Table 2 lists the classification, segmentation, and present conditions within the basin. The water quality problems of various segments are described below. The Weymouth River has not been segmented yet, and as such is not included in this section.

MYSTIC RIVER BASIN

Present Conditions

Segment 1 - Source to Inlet Mishawum Lake - The Aberjona River rises from a small impoundment in Reading. It is little more than a ditch which in summer months barely maintains any significant flow. The area is swampy. It is likely that high levels of nutrients can be found here.

Segment 2 - Inlet Mishawum Lake to outlet Mishawum Lake - Recently, the wetland referred to as Mishawum Lake has undergone drastic changes. The area has been almost completely developed as an industrial park. The Aberjona River has been partially channelized and culverted through the park and under Route 93. Previous discharge of toxic chemical wastes has infiltrated to groundwater. This is a definite threat to water quality. A research project is underway to determine how far the leachate has traveled throughout the aquifer.

Segment 3 - Outlet Mishawum Lake to inlet Burbank Pond - Here again, the river passes through industrialized land. Overland runoff contributes to the level of pollutants found in the river. Flows remain very low throughout the summer months. Below the developed area the river assumes a swampy character with no defined channel. Burbank Pond was at one time used as a cranberry bog.

Segment 4 - Inlet to outlet Burbank Pond - This former cranberry bog collects flows from upstream swampy areas. It serves to redefine the channel and reestablish river flow. Little is known about the water quality in this small impoundment. However, the likelihood of eutrophication is high, considering the input of nutrients from swampy areas above the pond.

Segment 5 - Outlet Burbank Pond to Sweetwater Brook - Flow improves in this section of the river. Dissolved oxygen averages 5.3 mg/l, an increase over upstream values. Nutrient values remain significantly high, but no additional discharges occur.

Segment 6 - Sweetwater Brook to Wedge Pond - The river improves slightly over this reach due to solids settling, BOD decay, nutrient uptake by aquatic vegetation, and improved dissolved oxygen due to photosynthesis and reaeration. Stormwater discharges occur in three locations as well as two minor cooling water discharges.

Segment 7 - Wedge Pond to Horn Pond Brook - This area comprises the third major tributary system to the Mystic. Urban stormwater runoff contributes to the pollution in the two impoundments. Water here meets C classification based on a 1971 survey conducted by Tufts University. There has not been any other sampling in this reach.

Segment 8 - Horn Pond to inlet Upper Mystic Lake - Here the river flows through a series of small impoundments. Some reaeration occurs and D.O. values increase. Water quality conditions continue to improve over this reach. Five stormwater discharges to this section of the river have been identified.

Segment 9 - Upper Mystic Lake - This lake has a total volume of 4,650 acre feet and a maximum depth of 82 feet. Formerly a water supply, the lake now can only sustain recreation at its northeastern shore. Three storm drains discharge to the lake or its tributaries. The lake presently suffers from high nitrogen levels, high temperatures, and low dissolved oxygen. It is believed that the Aberjona is the prime contributor to these conditions and as a result, the Upper Mystic Lake has been ranked as the second most polluted lake in the Commonwealth.

Segment 10 - Lower Mystic Lake - Water quality in the Lower Mystic Lake is currently below B classification. Pollution problems exist year round. The lake's Kettle Hole configuration plus completion of the Amelia Earhart Dam has resulted in the entrapment of large amounts of salt water below the fresh water layer. Even though this upper layer turns over in spring, it does not mix with the salt water below. The lower layer is anoxic (without dissolved oxygen) and serves as a sink for nutrients. Decomposing organic matter,solids and metals settling, and anaerobic conditions result in the production of noxious hydrogen sulfide gas. The upper layer is not without problems. Concentrations of ammonia are toxic to fish and nutrient levels are sufficient to sustain annual algal blooms. Coliform levels prevent any swimming in the lake.

Segment 11 - Outlet Lower Mystic Lake to Alewife Brook - Class C conditions are met in this reach. Pollution sources include the outflow from Lower Mystic Lake, Mill Brook, and two stormwater discharges from Arlington.

Segment 12 - Alewife Brook to Amelia Earhart Dam - Construction of the dam has eliminated tidal influence on this section of the river. Water quality here is considerably lower than that above Alewife Brook, the predominant source of pollution in this segment of the Mystic Basin. A C classification is not met. The Mystic is tidal below the dam. It is used extensively for shipping and is joined by the Chelsea and Island End rivers prior to becoming the Boston Inner Harbor. Petroleum and other industry-related discharges/spills contribute to pollution. Stormwater discharges are numerous, as well as those from combined sewers. Tidal action prevents the Mystic from becoming anaerobic and grossly polluted. Water quality nonetheless is marginal with SC conditions not being met.

NEPONSET RIVER BASIN

Segment 1 - Above Neponset Reservoir Dam - Dissolved oxygen in the pond is sufficient to maintain a suitable habitat for wildlife. However, coliform counts prevent swimming and other primary contact activities.

Segment 2 - Neponset Reservoir Dam to outlet Crackrock Pond Dam - Crackrock Pond is merely a wetland area choked with vegetation. It receives the discharge from the Foxboro State Hospital Treatment Plant. Coliform bacteria levels in excess of 1,000 per 100 ml were found during the 1973 survey. Dissolved oxygen here decreases. Nitrogen levels increase sharply, likely due to the swampy conditions which prevail.

Segment 3 - Summer St. Dam to above Bird Machine Co. diversion Dam - River flow improves in this segment. As a result, dissolved oxygen levels are maintained. There are no point sources of pollution found, which could be a reason for low concentrations of BOD found during the 1973 survey.

Segment 4 - Above diversion Dam to above Kendall Mills South St. Plant Dam - The river flows through an area of both commercial and industrial development. Stormwater discharges, urban runoff and industrial discharges cause a reduction in dissolved oxygen. Reaeration is hampered by the many impoundments in this section of the river.

Segment 5 - Above South St. Plant Dam to Main Plant Dam - Reaeration occurs with the passage of water over the dam. Dissolved oxygen concentrations increase accordingly.

Segment 6 - Kendall Mills Main Plant to outlet, Stetson Pond - Impoundment of the river, as well as an increase of BOD, cause another fluctuation in DO levels. An overall decrease in dissolved oxygen is noted. The short length of this and the previous reaches, numerous impoundments, and accumulation of pollutants precludes waste assimilation at an equal rate with reaeration. The result is a gradual degradation of the Neponset River.

Segment 7 - Outlet Stetson Pond Dam to outlet Bird Pond Dam - Bird Pond is a very long impounded section of the Neponset River. Travel time through the reach is somewhat longer than impoundments found upstream. As a result, DO and BOD concentrations increase and decrease respectively. Bird and Sons, Inc. has reduced its total discharge and has taken steps to clean river banks, thus reducing problems due to runoff and seepage.

Segment 8 - Outlet Bird Pond Dam to USGS Gauge, Norwood - Improved flow conditions contribute to better reaeration in the river. Dissolved oxygen continues to be replenished. BOD concentrations are diminished.

Segment 9 - USGS Gauge, Norwood to confluence with East Branch - River conditions are basically the same in this reach. The only significant change is that the drainage area becomes less developed, with industrially developed land giving way to open marsh and wetland. This is the beginning of Fowl Meadow Marsh.

Segment 10 - Confluence East Branch to Truman Highway Bridge - This extensive wetland area is known as Fowl Meadow Marsh. River flow is spread out for miles and the channel becomes undefined. Time of travel is difficult, if not impossible to measure. Because of high temperatures and little reaeration, DO again decreases. Nutrient levels increase, as well as BOD concentrations.

Segment 11 - Truman Highway Bridge to confluence with Mother Brook - There were no sampling stations on this section of the river during the 1973 survey. The area is still characterized by swamps and bogs. Flow characteristics also remain undefined.

Segment 12 - Confluence Mother Brook to Hollingsworth and Vose Dam - River conditions here are similar to those directly upstream. Impeded flow, low reaeration, and drainage from swamps keeps assimilative capacities to a minimum. No significant increase or decrease in D.O. or BOD is noted in water quality data.

Segment 13 - Hollingsworth and Vose Dam to Diamond International Dam - After leaving Fowl Meadow Marsh, the river channel becomes re-defined with attendant improved flow characteristics. D.O. levels reflect this change and are found to be 1 mg/l higher. Also, the stream's ability to stabilize organic wastes increases. Water quality data show a reduction in BOD levels.

Segment 14 - Diamond International Dam to Milton Lower Falls Dam - The level of dissolved oxygen continues to improve. Channelization and increased scope of the streambed cause the river to flow fairly rapid through Mattapan and Milton. The river is impounded by the Walter Baker Dam which separates the fresh water portion of the Neponset from its tidal portion.

TABLE 2

BOSTON HARBOR

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Aberjona River (19a)	To Hall's Brook	18.4-15.1	3.3	C	B
2	Aberjona River	Hall's Brook to Mishawum Road Bridge	15.1-14.8	0.3	U	B
3	Aberjona River	Mishawum Road Bridge to Inlet, Burbank Pond	14.8-13.5	1.3	U	B
4	Aberjona River	Inlet to outlet, Burbank Pond	13.5-13.3	0.2	U	B
5	Aberjona River	Outlet, Burbank Pond to Sweetwater Brook	13.3-12.0	1.3	U	B
6	Aberjona River	Sweetwater Brook to inlet, Pond 4	12.0-11.6	0.4	U	B
7	Aberjona River	Pond 4 to Horn Pond Brook	11.6-10.3	1.3	U	B
8	Aberjona River	Horn Pond Brook to inlet, Mystic Lake	10.3-9.2	1.1	U	B
9	Upper Mystic Lake	Inlet to outlet	9.2-8.1	1.1	C	B
10	Lower Mystic Lake	Outlet, Upper Mystic Lake to outlet, Lower Mystic Lake	8.1-7.4	0.7	U	B
11	Mystic River	Outlet, Lower Mystic Lake to Alewife Brook	7.4-6.5	0.9	C	C
12	Mystic River	Alewife Brook to Earhart Dam	6.5-2.0	4.5	U	C
2T	Malden River	Entire length	1.9-0.0	1.9	U	C
1T	Alewife Brook	Entire length	--	2.0	U	C
0	Neponset River (19c)	Above Neponset Reservoir Dam	Above 29.5	--	C	B

TABLE 2 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Neponset River	Neponset Reservoir Dam to outlet, Crackrock Pond Dam	29.5-28.95	0.60	C	B
2	Neponset River	Crackrock Pond Dam to Summer Street Dam, Walpole	28.95-27.33	1.62	C	B
3	Neponset River	Summer St. Dam to above Bird Machine Co. diversion dam	27.33-27.15	0.18	C	B
4	Neponset River	Above diversion dam to above Kendall Mills South Street plant dam	27.15-24.25	2.90	C	B
5	Neponset River	Above Kendall Mills South Street dam to main plant dam	24.25-23.47	0.78	C	B
6	Neponset River	Kendall Mills main plant dam to outlet, Stetson Pond Dam	23.47-22.62	0.85	C	B
7	Neponset River	Outlet, Stetson Pond Dam to outlet, Bird Pond Dam	22.62-20.75	1.87	C	B
8	Neponset River	Outlet, Bird Pond Dam to USGS, Pleasant Street, Norwood	20.75-19.2	1.55	U	C*
9	Neponset River	USGS, Norwood, to confluence with East Branch	19.2-15.8	3.40	U	C
10	Neponset River	Confluence with East Branch to Truman Highway bridge	15.8-8.9	6.90	C	C
11	Neponset River	Truman Highway bridge to confluence with Mother Brook	8.9-7.9	1.00	U	C

* Bird and Sons, Inc. has completed recycling system which has reduced total discharge; cleaning of river banks has reduced runoff and seepage of oil to river. This segment may now be meeting standards; unable to determine until resurveyed.

TABLE 2 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
12	Neponset River	Confluence, Mother Brook to Hollingsworth and Vose Dam	7.9-7.0	0.90	U	C
13	Neponset River	Hollingsworth and Vose Dam to Diamond International Dam	7.0-4.53	2.47	U	C
14	Neponset River	Diamond International Dam to Milton Lower Falls Dam	4.53-4.2	0.33	U	C

Total Miles of Class C - 21.0
Total Miles of Unsatisfactory Conditions - 24.65

LAKES AND PONDS

For this area only one intensive lake survey has been undertaken. This was for the Upper Mystic Lake and is found in a report entitled Upper Mystic Lake 1974-1975 Water Quality Study.

Inventory

	Boston Harbor	Mystic River Basin	Neponset River Basin	Weymouth River Basin
Number of Lakes and Ponds	13	44	65	22
Surface area of Lakes and Ponds (in acres)	573	1,473	1,893	1,083
Number of Lakes and Ponds greater than 10 acres	9	20	26	10
Surface area of Lakes and Ponds greater than 10 acres	549	1,345	1,700	1,029
Number of officially recognized Great Ponds	---	2	2	1
Surface area of officially recognized Great Ponds (in acres)	---	124	43	210

Classification

Name	Location	Drainage	Severity Points	Stratified/ Unstratified
Upper Mystic Lake	Arlington/Medford/ Winchester	Mystic River	15	S
Lower Mystic Lake	Arlington/Medford	Mystic River	12	S
Massapoag Pond	Sharon	Neponset River	7	S

III - BUZZARDS BAY BASIN

The Buzzards Bay drainage basin is formed by seven major coastal river basins which discharge their waters to the Massachusetts coastline from Bourne to Westport. The Cape Cod Canal determines the eastern border of the basin, while the Rhode Island state line defines the western border. From east to west, the major river basins are: Agawam, Wankinco, Weweantic, Mattapoisett, Acushnet, Paskamanset/Slocums, and Westport. The Buzzards Bay Basin has an approximate drainage area of 350 square miles. The 1970 population within the basin is estimated at 200,000 people (estimated from SENE Study figures).

Geologically, the Buzzards Bay Basin is characterized as a low granitic upland with glacial till and outwash deposits forming the soils. The terrain can be described as low and gently rolling, with elevations ranging from slightly more than 200 feet in the hilly northernmost portions of the basin to sea level at the coastline. The minimal elevation change in the basin accounts for the meandering nature of most of the rivers.

The straight-line distance of the Buzzards Bay coastline is 32 miles, but its actual total length is 210 miles when all the unconformities are accounted for. The numerous harbors and coves formed by the jagged coastline are used extensively for recreational and commercial purposes. New Bedford Harbor, which is famous for its whaling history, is the industrial and commercial center of the basin and, in turn, suffers the most severe water quality problems. These can be mainly attributed to discharges of sewage from combined sewer overflows and varied industrial discharges. The problems plaguing other harbors within Buzzards Bay include discharges of sanitary wastes from municipal collection systems and from watercraft. Oil pollution from the on-shore terminals and the off-shore tankers is a problem that is common to the entire coastline of Buzzards Bay.

With the exception of the Acushnet River and New Bedford Harbor area, industrial wastewater discharges are few in number and have little impact on the quality of the receiving waters.

There are five municipal wastewater treatment plants serving the communities of Wareham, Marion, Fairhaven, New Bedford, and Dartmouth. The New Bedford facility provides primary treatment, while the remaining plants offer at least secondary treatment.

Non-point pollution sources to the rivers and harbors of Buzzards Bay include stormwater runoff, agricultural runoff, and possibly leachate and landfill runoff. Included within the category of agricultural runoff is the use of pesticides by the cranberry industry which has in past years been responsible for fish kills in rivers located in the eastern portion of the basin. Wetland areas, in certain instances, are considered natural non-point sources of pollution because of high color, high carbonaceous oxygen demand, and low dissolved oxygen waters contributed by them to streams.

Water Quality Surveys

During the summer of 1975, the Division of Water Pollution Control surveyed the major rivers and harbors within Buzzards Bay. A total of four weeks were spent on data collection from approximately sixty sampling points within the basin. The results of these surveys have been published by the Division in a report entitled Buzzards Bay 1975 Part A, Water Quality Data.

Major wastewater discharges to the Buzzards Bay were sampled during October 1975. Selected discharges were again sampled during September 1976. The sampling results have been published by the Division in a report entitled Buzzards Bay 1975-1976 Part B, Wastewater Discharge Data.

Basin Segmentation

To facilitate water quality analysis of the basin, various waterbodies were physically segmented according to similar characteristics. Segment divisions were a result of a change in hydrology, a variation of the water quality due to an addition of pollutants, or a change in the river's classification.

The segments for the Buzzards Bay Basin are listed in Table 3. It is seen from the table that the segments generally comprise an entire harbor or river.

From Table 3 it can also be seen that segments have been assigned a present condition and a future use classification. The future use classification is based on the present water quality standards, while the present condition is based on the results of the 1975 water quality survey.

Present Conditions

Segment 1 - Buttermilk Bay - Buttermilk Bay is located on the northern shore of the southern entrance to the Cape Cod Canal. It would, therefore, be subject to the effects of wastewater discharges to the canal, dependent upon the tides. There are no known major point discharges of wastewater to Buttermilk Bay. The 1975 Buzzards Bay survey had one station on Miller Cove, MC1, which forms a portion of Buttermilk Bay. The survey results indicate the water to be of excellent quality. The surrounding area is heavily developed, however, and is not sewered; thus there is the possibility of localized water quality problems from failing septic systems. At the time of sampling, what would be considered excessive amounts of algae were apparent, indicating that nutrient-rich waters, likely a result of failing septic systems, were present. Unfortunately, the restrictions on laboratory personnel and equipment did not permit a microscopic analysis of this sampling station.

The Cape Cod Canal receives wastewater discharges from the Canal Electric Company (primarily cooling water), Massachusetts Maritime Academy, Canalview Apartments, and a Coca-Cola plant. No effect from these discharges is likely in Buttermilk Bay or any other area of Buzzards Bay, due simply to dilution of the wastewater.

There is heavy oil-tanker traffic through the Cape Cod Canal, and the possibility of a serious oil spill is always present. Oil pollution of a minor nature results from the high concentration of pleasure craft in these waters, especially during the summer months. More importantly, discharges of untreated sanitary wastes from the larger watercraft create localized water quality problems, thus endangering the usage of these waters for shellfishing and swimming. Presently, there are no areas of Buttermilk Bay closed to shellfishing.

Segment 2 - Onset Bay - Onset Bay is to the immediate west of Buttermilk Bay and is similar in most respects. It receives no known point discharges of wastewater. The 1975 Buzzards Bay survey had one station (ER1) at the mouth of the East River which forms a small cove in Onset Bay. The sampling results show that, in general, this water is of the highest quality. Again, as is the case of Buttermilk Bay, it is impossible to fully assess the water quality of Onset Bay from the results of one sampling station. The surrounding area is not sewered and is intensively developed. Sampling of a more specific nature would be necessary to determine whether septic tank leachate is a problem in localized areas.[1] Onset Bay supports heavy recreational boating during the summer months and, therefore, discharges of sanitary wastes from watercraft are likely. Oil pollution from pleasure craft and, more importantly, from offshore oil tanker traffic is always possible.

With the exception of Muddy Cove, Onset Bay is open to shellfishing. Muddy Cove has not been closed for reasons of lowered water quality but for the purpose of oyster propagation.

Segment 3 - Agawam River, headwaters to Wareham STP discharge - The 1975 Buzzards Bay survey had four sampling stations on the Agawam River. Station AG1 was located at the outlet of Halfway Pond in Plymouth, which is the origin of the Agawam River. There are no known sources of pollution to the

[1]Results of storm drain sampling by the Division's Southeast Regional Office on coastal portions of the Wareham River indicate that septic tank leachate is a problem common to intensely developed coastal areas.

Agawam River above this point; therefore, AG1 was chosen as a clean water station against which comparisons could be made with data collected from downstream stations.

The sampling results show the Agawam River to be well within Class B requirements at Station AG1. Nutrient levels were consistently low and, as would be expected, microscopic analyses found algal concentrations also low. A microscopic analysis was possible for the July survey only; therefore, the actual algal population in August is unknown. The nutrient levels remained low for both months and were insufficient to support any algal "blooms." Although the water temperatures recorded during the August surveys were lower than those of the July surveys, overall higher temperatures during the month of August likely resulted in an increased biomass concentration at that time. The BOD_5 in July averaged 1.7 mg/1, which is indicative of clean water; while in August it jumped to an average of 4.4 mg/1. The COD averaged 14 mg/1 in July and 16 mg/1 in August, indicating only minor additional inputs of organic material. The demand exerted by the algae through respiration and decay is believed to be reflected in the higher BOD_5 levels found in August.

Station AG2 was located 5.2 miles downstream at the outlet of Glen Charlie Pond in Wareham. There are no known point discharges of wastewater to the Agawam River between these stations, and the sampling results from AG2 indicated this. The nutrient levels remained consistently low; but, as noted at Station AG1, the BOD_5 level increased from 1.8 mg/1 in July to 4.9 mg/1 in August. This is again believed to be attributable to the increased algal population in August.

Station AG3 was located 2.0 miles downstream from Station AG2 at the outlet of Mill Pond on Route 28 in Wareham. Shortly below this point, the Agawam River becomes tidally influenced. The water quality of the Agawam River at Station AG3 was nearly identical to that found at Station AG2 and well within Class B requirements.

Segment 3a - Agawam River, Wareham STP discharge to river mouth - Sampling Station AG4 was located 1.2 miles downstream of AG3 on Route 6 in Wareham. This point is shortly downstream of the discharge from Wareham's municipal wastewater treatment plant.

As expected, increases in nutrient levels were found which can be attributed to the treatment plant. The Wareham facility is of extended aeration design and uses sand beds to polish the effluent prior to discharge to the river. The survey results indicated that, other than slightly increased nutrient concentrations which are still considered well within Class B criteria, this highly treated discharge has little impact on the quality of the Agawam River. The following charts contrast the quality of the Agawam River before (AG3) and after (AG4) the point of discharge for the July and August surveys. (Units are expressed in mg/1 unless otherwise noted.)

JULY

	BOD_5	NH_3	NO_3	TOTAL P	TOTAL COLIFORM/100 ml
AG3	1.6	0.02	0.0	0.02	14
AG4	1.3	0.06	0.1	0.06	55

AUGUST

AG3	4.2	0.02	0.0	0.01	39
AG4	4.2	0.09	0.1	0.02	950

Again, the higher BOD_5 values in August are believed due to the increased algal population. The presence of algae in August is also indicated by a more pronounced diurnal fluctuation in dissolved oxygen values noted at all sampling stations due to increased photosynthesis during August.

The dissolved oxygen data collected from all four sampling stations show the Agawam River in general was well above the 5.0 mg/1 minimum allowable Class B requirement.

At Station AG4, wide fluctuations in the dissolved oxygen values were found, probably caused by the higher nutrient levels and resultant algal population. Minimum dissolved oxygen concentrations at times approached the 5.0 mg/1 minimum allowable concentration, but only once during either survey was there a violation (4.7 mg/1). This is not considered a problem at the present time, but it indicates that increased flows from the Wareham treatment plant in the future could result in dissolved oxygen problems downstream.

Segment 4 - Wankinco River - The Wankinco River Basin is to the west and adjacent to the Agawam River Basin. The two rivers converge near Wareham Center to form the Wareham River. Like the Agawam River, large wetland areas form much of the Wankinco's drainage basin and numerous impoundments are found along the main stem. The Tremont Nail Company discharges cooling water and wastes from a pickling operation to the Wankinco River. This discharge and two sanitary landfills near the river's course largely determined the placement of the sampling stations.

Near the headwaters of the Wankinco River, a regional landfill site serving the communities of Wareham, Carver, and Marion is located. Station W01 was located above this site on the Wankinco River in Carver at mile point 4.5. There are no known sources of pollution above this point; therefore, Station W01 is considered a "clean water" station.

Because the nature of the watersheds is similar, the water quality of the Wankinco River approximates that of the Agawam River. Nutrient levels were very low for both the July and August surveys. As observed on the Agawam River, the BOD_5 levels jumped, from an average of 1.3 mg/1 in July to 4.2 mg/1 in August. The diurnal fluctuation in dissolved oxygen concentrations increased also and here again, the higher BOD_5 values in August are due to the effects of algae.

Total coliform bacteria were consistently found in concentrations slightly in violation of Class B standards at Station W01. The source is unknown and further investigation is required. All other parameters were well within the standards, indicating that the unknown source of pollution is minor in nature.

Station W02 was located slightly downstream of the regional landfill site, on the Wankinco River in Carver. The regional landfill has been in operation a relatively short period of time; consequently, the sampling results showed it had no effect on the water quality of the Wankinco River. These data will be useful in assessing any effects this landfill may have on the river in the future.

Station W03 was located on the Wankinco River in Wareham, immediately downstream of the discharge from the Tremont Nail Company. The original intent of this sampling site was to assess the effects of the waste discharge from the Tremont Nail Company. Also of importance were any possible impacts the former Wareham landfill site, located shortly upstream, had on the Wankinco River. Unfamiliarity with the discharge point from the Tremont Nail Company resulted in the effects of this discharge being missed entirely at W03. It would have been difficult, however, to separate the impacts of the sources, had both been present at Station W03.

The former Wareham landfill is no longer in use and has been covered. It has not been capped, however, and the bare soil will likely in time allow the build-up of a groundwater dome due to the high infiltration rate. This, in turn, will increase the possibility of leachate from the landfill entering the Wankinco. Phosphorus and COD at W03 indicate that possibly some leachate is presently entering the Wankinco River from the landfill. Another possible source is the regional septage handling lagoons which are located to the west of the Wankinco River. Despite the increases in pollutant levels, the Wankinco River at Station W03 is still of Class B quality.

Dissolved oxygen values were generally well above the 5.0 mg/l minimum allowable for Class B waters at all three stations. There was little diurnal fluctuation in dissolved oxygen concentrations, which can be attributed to the small algal population which, in turn, resulted from the lack of nutrients.

Segment 5 - Wareham River - Approximately four-tenths of a mile downstream from Station W03, the Wareham River is formed by the confluence of the Agawam and Wankinco Rivers. Station WM1 was located one-tenth of a mile downstream from this confluence. The Wareham River is 2.6 miles long and tidally influenced its entire length.

As expected, the results from Station WM1 showed the Wareham River at this point to be of the same quality as the rivers forming it.

Wareham Center is located upstream of Station WM1 on the western bank of the Wankinco River. Any effects of stormwater runoff from Wareham Center on downstream waters are difficult to assess due to the lack of any appreciable precipitation during any of the sampling periods.

As would be expected, fluctuations in the BOD_5 results were similar to those in the Wankinco and Agawam Rivers from July to August with averages of 1.5 mg/l and 4.2 mg/l found in those months, respectively. This is again believed due to the increased algal population in August and the decreased flow which acted to concentrate the pollutants.

The most noticeable change in water quality at WM1 is the increase in ammonia-nitrogen. Concentrations of ammonia-nitrogen were never found in excess of 0.09 mg/l in the Agawam or Wankinco Rivers; while at WM1, ammonia-nitrogen averaged 0.18 mg/l in July and 0.32 mg/l in August. A clean-water ocean sampling station on Aucoot Cove indicates that these levels of ammonia-nitrogen are not due to any single pollution source, but are merely background levels found in Buzzards Bay.

Station BM1 was located 0.9 miles downstream of Station WM1 at the mouth of the Broad Marsh River, a tidal estuary of the Wareham River. The results from BM1 indicate the Broad Marsh River is of approximately the same quality as the Wareham River. On the basis of the results from stations WM1 and BM1, these waters are meeting their Class SA requirements. The coliform bacteria levels found were usually under 700/100 ml, which is the median level allowable for SA waters. Previously, there were high coliform bacteria concentrations in the upper reaches of the Broad Marsh River which were due to leachate from failing septic systems. For this reason, the Massachusetts Department of Environmental Quality Engineering, Division of Water Supply, had closed 38 acres of the Broad Marsh River to shellfishing. This area has since been sewered to the Wareham wastewater treatment plant, which has improved the water quality sufficiently to again permit shellfishing.

A minimum dissolved oxygen concentration of 5.8 mg/l was recorded at Station WM1, which is in violation of the 6.5 mg/l minimum allowable for SA waters. The average concentrations for July and August were 7.3 and 7.4 mg/l, respectively,at Station WM1. Minimum D.O. concentrations of 8.2 and 8.5 mg/l at BM1 indicate that, shortly downstream of WM1, low dissolved oxygen concentrations are not a problem. Therefore, the minimum D.O. values recorded at Station WM1 are not sufficient to consider the Wareham River in violation of its classification. It should be noted that the 6.5 mg/l minimum D.O. requirement for Class SA waters is unrealistic, considering that the high water temperatures recorded during the surveys acted to decrease the saturation value to approximately 7.3 mg/l in saltwater (15,000 mg/l chlorides, 75°F).

During the summer months the Wareham River supports heavy recreational boating. It is likely that, at these times, untreated sanitary discharges from the watercraft produce localized areas of lower water quality.

Oil spills on the Wareham River from fuel oil dealers in Wareham Center have been a problem in the past and likely will continue to be so in the future. Like Buttermilk and Onset Bays, the Wareham River is also subject to oil spills from offshore oil tanker traffic.

The Division's Southeast Regional Office (SERO) conducted sampling on September 28, 1976, of storm drains in the areas of Pinehurst Beach, Swift's Beach, and Pine Point, which are coastal areas of the Wareham River. The results indicate that septic tank leachate is a serious problem to the river. Therefore, despite the results from the 1975 survey which indicate that few water

quality problems exist, the Wareham River is considered to be of SB quality based on SERO's sampling results and problems which are known to occur periodically due to the above-cited sources.

Segment 6 - Weweantic River - above outlet of Horseshoe Pond - The Weweantic River Basin lies to the west of the Wankinco River Basin and is similar in nature. Much of the drainage area consists of wetlands, and numerous cranberry bogs are scattered throughout the basin. The intensive use of this basin by the cranberry industry has made the Weweantic River well known for its pesticide pollution problems. This is a problem shared in all the basins in the eastern portion of Buzzards Bay; but due to a number of large fish kills on the Weweantic River, studies have centered in this area. The Weweantic has been considered as a possible water supply by area communities; thus, its water quality is of great importance.

There are no known direct discharges of wastewater to the Weweantic River. Within the drainage basin are found three landfill sites, two of which are no longer in use. The remaining active site is well situated and there appear to be no important runoff or leachate problems with this or the other landfill sites.

The sampling points on the Weweantic River were chosen rather randomly due to the fact that no pollution sources were known to exist (other than the previously mentioned pesticides).

Station WE1, the most upstream sampling point, was located on Rochester Road on the Middleborough-Carver line, at river mile 12.1. The sampling results indicate that there are no major water quality problems resulting from the two former landfill sites located upstream.

During the July survey, the dissolved oxygen concentration averaged 3.3 mg/l while in August it averaged 5.9 mg/l. A few days before the July survey, it rained on the order of one to two inches, while the days before the August survey were relatively dry. The flow recorded at Station WE1 in July was approximately triple the August flow. It appears that the precipitation before the July survey acted to flush out the wetland areas. This water is naturally stagnant and characteristically low in dissolved oxygen content. The higher color values found in July also indicate that wetland waters were the source of the low dissolved oxygen values.

As observed in the neighboring river basins, the BOD_5 values increased from July to August, while the COD values remained relatively constant. The BOD_5 averaged 1.3 mg/l and 4.2 mg/l in July and August, respectively. This increase is due to the effects of a larger algal population in August. The COD values averaged 36 mg/l in July and 34 mg/l in August, indicating that the concentration of organics varied little.

Ammonia- and nitrate-nitrogen were found in very low levels or were nonexistent for both months. During the July survey, the total phosphorus averaged 0.10 mg/l, somewhat higher than expected; while in August an average of 0.04 mg/l was recorded. The higher July values are likely due to the flushing of wetland areas from the heavy precipitation.

The total coliform bacteria concentrations averaged 200/100 ml and 350/100 ml for July and August, respectively, which are well within Class B criteria.

The dissolved oxygen concentrations below the minimum allowable 5 mg/l for a Class B stream are due to natural stream conditions. For this reason the Weweantic River is considered as meeting Class B criteria at Station WE1.

Station WE2 was located 4.1 miles downstream at Route 28, Wareham. The water quality at this station is nearly identical in all respects to that observed at WE1. One exception is the dissolved oxygen concentration, which averaged 4.7 mg/l in July. The increase from Station WE1 to WE2 is due to stream reaeration.

Station WE3 was located on Squire Island Road in Wareham, 2.8 miles downstream from Station WE2. Again, water quality here was identical to that observed at WE1 and WE2. The dissolved oxygen concentrations showed continued recovery, with a minimum of 6.1 mg/l and an average of 7.1 mg/l in July.

The Weweantic River has been designated a Class B stream by the Division from its headwaters to the outlet of Horseshoe Pond. The results from sampling stations WE1, WE2, and WE3 indicate the water quality of the Weweantic River to be within Class B criteria.

Segment 7 - Weweantic River - outlet of Horseshoe Pond to river mouth - Downstream of the outlet of Horseshoe Pond, the Weweantic River becomes tidal. From the outlet of Horseshoe Pond to the mouth, the river has been assigned an SA classification by the Division.

The final station on the Weweantic River was located on Route 6 on the Marion-Wareham line. This point is downstream of the confluence with the Sippican River and is 2.1 miles upstream of the mouth of the Weweantic River. The Weweantic is dominated by the tides at WE4; therefore, high and low tide samples were collected to observe the extremes of dilution.

Actually, little difference was noted between the high and low tide sampling results. The ammonia-nitrogen concentration was noticeably higher for the high tide samples, which is due to the background concentration found in Buzzards Bay. Likewise, the total phosphorus concentration increased to background levels.

Dissolved oxygen concentrations for both the July and August surveys were generally above the 6.5 mg/l minimum allowable for SA waters. The total coliform bacteria concentrations were at all times well within Class SA requirements at Station WE4. The Weweantic River is open to shellfishing and, on the basis of the results from Station WE4, is meeting Class SA criteria.

Segment 8 - Sippican River - above County Road - The Sippican River is tributary to the Weweantic River from the west at river mile 2.2. Its watershed is similar to that of the Weweantic River and, as expected, the sampling results are also similar.

Station SIR1 was located at Pierceville Road in Rochester at river mile 6.8. There are no known sources of pollution to the Sippican River other than the previously mentioned pesticides problem common to all rivers in this portion of Buzzards Bay.

The dissolved oxygen concentrations at Station SIR1 for both the July and August surveys were consistently below the 5.0 mg/1 minimum allowable concentration for Class B waters.

As noted on the Weweantic River, the BOD_5 values differed for July and August. In July, the BOD_5 averaged 1.4 mg/1; in August, it averaged 4.3 mg/1. The increase in five-day BOD in August is interesting since the COD actually decreased from an average of 40 mg/1 in July to 25 mg/1 in August. Thus, the increase in BOD_5 is attributed to the effect of algae on the BOD test.

It is obvious from the BOD results that the low dissolved oxygen concentrations are not due to the demand exerted by large amounts of organic material. Rather, these values are believed due to the naturally occurring low dissolved oxygen content found in wetland waters and the sluggish nature of the Sippican River. For this reason, the low dissolved oxygen values are not considered in violation of Class B criteria.

The nutrient levels at SIR1 are typical of those found on the Weweantic River. Ammonia-nitrogen averaged 0.04 mg/1 for both months, while no nitrate-nitrogen was found during either survey. The total phosphorus averaged 0.08 mg/1 in July and dropped to 0.02 mg/1 in August. The higher values in July are due to the heavy precipitation prior to sampling which tended to flush the wetlands.

Segment 9 - Sippican River, County Road to river mouth - Station SIR2 was located 4.7 miles downstream from SIR1, at river mile 2.1. The Sippican River is still freshwater at this point but becomes tidally influenced a short distance downstream. A recovery in the D.O. concentrations was observed at SIR2, with a minimum D.O. of 4.3 mg/1 recorded in July and 5.0 mg/1 in August.

The nutrient concentrations at SIR2 were comparable to those found at SIR1 except for the appearance of 0.2 to 0.3 mg/1 of nitrate-nitrogen during both surveys. The BOD_5 values varied as previously noted at Station SIR1.

The total coliform bacteria concentrations found at SIR2 were slightly in violation of Class SA criteria for both surveys. This portion of the Sippican River is, therefore, considered to be of SB quality. The source of the bacteria is unknown, but the Sippican River, despite this, poses minimal pollution problems to the Weweantic River.

Segment 10 - Sippican Harbor - Sippican Harbor has been classified as an SA body of water by the Division. All but a small portion of the harbor is presently of SA quality and is, therefore, open to shellfishing. A

small cove at the head of the harbor has been closed to shellfishing due to high concentrations of mercury. The Massachusetts Department of Environmental Quality Engineering has identified the source as mercury-based anti-foulant paints used on the hulls of racing craft.

Sampling was conducted at three stations within the harbor during the July survey at low tide. The sampling program was expanded during the August survey to include both high and low tide samples. Where depths exceeded approximately three feet, both top and bottom samples were collected for chemical and bacteriological analysis.

The sampling results from all three stations indicate that there was little difference between top and bottom, or high and low tide samples. Sippican Harbor is relatively long and narrow, but there are no restrictions at its mouth to prevent complete mixing of the water column at all times.

One of the most important criteria in evaluating the quality of SA waters open to shellfishing is the concentration of coliform bacteria. In general, the total coliform bacteria concentrations found during both surveys were extremely low, with most counts less than 10 coliform/100 ml.

Sippican Harbor is used extensively for recreational boating purposes during the summer months. There is a significant increase in the amount of organic material in the harbor on weekdays which is reflected in the higher BOD_5 results from Tuesday's samples. This increase in organics can be attributed to the large numbers of pleasure craft with onboard sanitation facilities which are moored in the harbor and to the use of these facilities on weekends. Thursday's samples indicated that, during the week, the organic loading is minimal and the harbor flushes itself.

The BOD_5 results showed the same overall trend during the August survey, but were considerably higher. This is probably due to the continued discharge of sanitary wastes from pleasure craft and the resultant accumulation of organic material. In August, it is likely that an increased algal population would tend to produce higher BOD_5 results.

During the August survey, the amount of suspended solids increased noticeably at all three sampling stations, further indicating a high degree of organic material present. This increase in organics could also be attributed to water-contact recreational activities which would tend to suspend bottom matter.

In a freshwater environment, discharges of sanitary wastes would be indicated by high counts of coliform bacteria in addition to an increase in the BOD_5 values. This is not the case, however, in a saltwater environment. Coliform bacteria die off rapidly when exposed to high salinity and intense sunlight. During the Buzzards Bay surveys, weather conditions were favorable for long hours of sunlight. This, in addition to the high salinity, produced the low coliform bacteria concentrations observed at the open-ocean "clean water" stations in Buzzards Bay.

The nutrient concentrations found at stations SIH1, 2, and 3 were representative of the background concentrations observed at the open-ocean "clean water" stations in Buzzards Bay.

Segment 11 - Aucoot Cove - Aucoot Cove is the receiving water for the secondary treated effluent from Marion's wastewater treatment plant. There are no other known wastewater discharges to Aucoot Cove, but problems from septic tank leachate are known to exist, primarily in the Hiller Cove, Harbor Beach area of Mattapoisett.

Two sampling stations were located in Aucoot Cove. Station AC1 was a "clean water" station at the mouth of the cove. Its purpose was to provide a point of reference against which the results from other tidal sampling stations could be compared.

The effluent from Marion's treatment facility is discharged to a small stream which enters the head of Aucoot Cove. Sampling station AC2 was located in the vicinity of the mouth of the stream with the intent of assessing the water quality impact of Marion's discharge. To maintain the quality of the shellfishing flats of Aucoot Cove, this discharge is lagooned during the summer months; thus, it proved impossible to assess its impact at this time.

The results from both stations indicate that Aucoot Cove is a high-quality shellfishing area that is well within its Class SA requirements.

Segment 12 - Mattapoisett River - The Division has classified the Mattapoisett River as a Class B stream. Its water quality is of special interest due to the municipal well fields near its course which serve the communities of Fairhaven and Mattapoisett. There are no known sources of either point or non-point pollution to the Mattapoisett River.

Sampling station MA1 was located at river mile 9.5 on the Snipatuit Road. This site is a short distance downstream from the outlet of Snipatuit Pond, which forms the headwaters of the Mattapoisett River.

The BOD_5 results averaged 1.2 mg/l in July and 2.2 mg/l in August, which are indicative of high quality water. The nutrient levels were likewise relatively low for both months.

Dissolved oxygen concentrations were often found below the 5.0 mg/l minimum allowable for Class B waters. The flow at Station MA1, which was extremely low for both surveys, was comprised mainly of leakage through an outlet structure of an impoundment located immediately upstream. This produced near-stagnant conditions and thus little reaeration. A pronounced fluctuation in the dissolved oxygen concentration due to photosynthesis produced values during the early morning hours as low as 0.4 mg/l.

At sampling station MA2, river mile 3.8, the Mattapoisett River is meeting Class B requirements, but there are increases in the COD, BOD_5, and nutrient values. This is probably due to an input of organic material from the large wetland areas within the watershed. Minimum D.O. concentrations of 4.2 mg/l in July and August were recorded, with averages of 4.9 and 5.9 mg/l, respectively.

Station MA3, at river mile 1.7, was the final sampling station on the Mattapoisett River. Shortly downstream of this point, the river becomes tidal and then discharges to Mattapoisett Harbor.

Between stations MA2 and MA3, no significant change in water quality occurs other than the dissolved oxygen concentrations which continued to recover, with minimum values of 4.4 mg/l in July and 5.1 mg/l in August.

The coliform bacteria concentrations at stations MA1 and MA2 were generally within Class B requirements. On August 26, 1200 coliform/100 ml were recorded at MA1; while on July 15, 2700 coliform/100 ml were found at MA2. These counts are not sufficient cause to consider the Mattapoisett River in violation of its B classification, but they do indicate the possibility of minor unknown sources of pollution.

The low dissolved oxygen concentrations found at all three sampling stations are due to the characteristically low D.O. content of wetland waters which comprise much of the river's total flow and to the sluggish nature of the river itself. Because the low D.O. values are due to natural causes, the Mattapoisett River is considered to be of Class B quality.

Segment 13 - Mattapoisett Harbor - Mattapoisett Harbor has been classified as an SA body of water by the Division of Water Pollution Control. Nineteen acres of the harbor in the vicinity of the town pier have been closed to shellfishing by the Division of Water Supply, Shellfish Section (formerly in the Department of Public Health). The closure was necessary due to discharges of raw sewage at the Town Pier from a small stormwater and sanitary collection system serving Mattapoisett Center.

Two small unnamed streams which discharge to Mattapoisett Harbor were sampled in addition to three sampling points in the harbor itself. Sampling stations MH1 and P12 were located near the mouth of each of these streams, and the sampling results show both to have significant pollution problems. The stream which enters Pine Island Pond and which was monitored by Station P12 receives a secondary discharge from the Rochester Regional High School. The other stream flows through Mattapoisett Center and appears to be subject to leachate from failing septic systems. The flow of these streams, however, is negligible during most of the year; therefore, they have little impact on the water quality of Mattapoisett Harbor.

Sampling station MH3 was sited in Mattapoisett Harbor in the vicinity of the discharge at Town Pier, with the intent of assessing this discharge's impact on the water quality of the harbor. Sampling station MH4 was positioned much farther out, near the mouth of the harbor, to provide an overall assessment of the harbor's quality.

A comparison of stations MH3 and MH4 for both the July and August surveys shows no apparent difference in quality between the two sampling sites. A degradation in the overall quality of the harbor was observed at both stations from July to August.

Total coliform bacteria were found in concentrations well below Class SA criteria at stations MH3 and MH4. The low values are due to the rapid die-off rate coliform bacteria experience under high salinity and intense sunlight conditions.

The nutrient concentrations found at stations MH3 and MH4 are comparable to those found at "clean water" station AC1.

Overall, Mattapoisett Harbor is of SA quality but has obvious problems which are the result of raw sewage discharges at Town Pier. Certain areas of the harbor, particularly the 19 acres closed to shellfishing, are considered to be of Class SB quality, suitable for swimming but not for shellfishing, due to the differing coliform bacteria requirements for each activity.

Segment 14 - Nasketucket Bay - Nasketucket Bay is among the highest quality bodies of water within Buzzards Bay. It receives no wastewater discharges and is open to shellfishing. Due to its expected high quality, the Division has had no sampling stations on the bay.

Segments 15 & 16 - New Bedford Reservoir; Acushnet River to Hamlin Road - The headwaters of the Acushnet River are formed by the New Bedford Reservoir, which is no longer in use but serves as an emergency water supply. The outlet of the New Bedford Reservoir is the start of the Acushnet River. Station AR1, located at the outlet, was the "clean water" station for the 1971 and 1975 surveys.

As expected, the quality of the Acushnet River at this point is excellent and was well within Class B criteria for both surveys. There are no pollution sources to the reservoir; therefore, little change in quality has occurred during the years from 1971 to 1975.

Segment 17 - Acushnet River from Hamlin Road to Main Street - Station AR3, at river mile 5.5, was a station common to both surveys. Upstream of this point, wastes from White's Dairy Farm enter the Acushnet River as a direct discharge to a feeder stream (Station AR2a) and as runoff.

In 1971, the Acushnet River at Station AR3 was severely degraded due to this source of pollution. The dissolved oxygen concentrations were often found near zero. The dairy wastes were still a problem in 1975, but to a much lesser degree.

The survey results from Station AR2a in 1975 show the feeder stream conveying the dairy wastes to be heavily polluted. Its flow is minimal, however, thus limiting its impact on the Acushnet River. Despite the improvement in water quality at Station AR3 between 1971 and 1975, the river is still below Class B criteria. Minimum dissolved oxygen concentrations of 3.8 mg/l in July and 4.3 mg/l in August were recorded. Since 1971, a small impoundment upstream of Station AR3 has been drained, alleviating in part the low dissolved oxygen problems.

A range of 9.0-3.8 mg/l of dissolved oxygen in July and 11.0-4.3 mg/l in August 1975 indicates a high degree of photosynthetic activity which can be attributed to the abundance of nutrients from the dairy wastes. Elimination of this pollution source would likely increase the minimum dissolved oxygen concentrations and decrease the wide fluctuations in range.

Coliform concentrations well in excess of Class B criteria were found at Station AR2a. In general, at Station AR3, coliform bacteria concentrations were within Class B criteria, in contrast to 1971 when a maximum value of 240,000 coliform/100 ml was found.

Considerably more severe D.O. problems were found at the outlet of Sawmill Pond, Station AR5, at river mile 4.6. In July and August of 1975, the BOD_5 values averaged 1.3 mg/l, which is indicative of high quality water. The dissolved oxygen concentrations averaged 2.3 mg/l in July and 1.5 mg/l in August 1975. A range of only 4.8-1.9 mg/l of dissolved oxygen in July and 2.3-0.9 mg/l in August indicates that there is little photosynthetic activity. Between stations AR3 and AR5, the river is slow-moving due to the small change in elevation. The relatively long time of travel through Sawmill Pond produces low D.O. values due to the assimilation of organic material and the low reaeration rate. The depth of the pond is such that rooted aquatics are not abundant; thus, oxygen is not replenished through photosynthesis. A microscopic analysis of Station AR5 during the July survey showed algae to be almost totally absent.

Between 1971 and 1975 at Station AR5, slight decreases in nitrogen, phosphorus, and BOD_5 concentrations indicate a minor improvement in water quality, but low dissolved oxygen values persist. Therefore, the Acushnet River is in violation of Class B standards at Station AR5.

A small dam at the outlet of Sawmill Pond reaerates the Acushnet River, resulting in a tremendous improvement in the D.O. concentration. This improvement was monitored at Station AR6, located one-tenth of a mile downstream at river mile 4.5. At this point, the Acushnet River is primarily freshwater but is tidally influenced. In 1971, a minimum D.O. concentration of 3.8 mg/l was recorded; while in 1975, minima of 4.9 mg/l for both surveys were found. Average values for 1971 and 1975 are not comparable due to the differing sampling procedures. In 1971, samples were collected primarily during daylight hours, whereas in 1975, samples were collected at four-hour intervals on a 24-hour basis to yield a more accurate average.

Between stations AR5 and AR6 are numerous discharges of raw sewage from private dwellings. Due to the minor nature of these discharges, little water quality degradation is actually seen at Station AR6. The coliform bacteria concentrations did increase to an average of 15,500 col/100 ml in July and 10,000/100 ml in August 1975. These values are an improvement over the maximum of 240,000/100 ml found in 1971.

In 1975, the Acushnet River at Station AR6 is still considered in violation of Class B criteria due to the high coliform bacteria concentrations.

Segments 18 & 19 - Acushnet River from Main Street to Route 6; New Bedford Inner Harbor - Stations AR7, AR8, and NB1 were located on the Acushnet River and New Bedford Inner Harbor, which have been classified as SB by the Division and are physically the same body of water. In 1971, top and bottom sampling was conducted at three points across the harbor which were referred to as west, middle, and east. The results from 1971 indicated only minimal differences among the samples from each transect and little change between top and bottom; therefore, only mid-channel, mid-depth sampling for chemical analysis was conducted in 1975. The stratification of saltwater and freshwater in the harbor did greatly affect the coliform bacteria concentrations; therefore, top and bottom sampling for bacteria was continued.

The 1975 surveys show an overall improvement in the quality of Inner New Bedford Harbor. This can be attributed to actions taken by the City of

New Bedford to limit dry weather flows from combined sewer overflows and the connection of numerous sanitary and industrial discharges to municipal sewer lines.

In 1971, a newly constructed secondary wastewater treatment plant serving the community of Fairhaven had recently been placed on line with the effluent entering the New Bedford Harbor inside the hurricane barrier. During the 1971 survey, the plant was experiencing operational problems and was discharging an effluent of less than secondary quality. At the time of the 1975 surveys, the effluent was of excellent quality and the plume was barely distinguishable.

In 1971, the total coliform bacteria concentrations were considerably higher than 1975 at all inner harbor stations. This is due to the raw sewage flows from the sources previously mentioned. The results from both years show a large variance in coliform concentrations for samples collected from top and bottom waters. Much higher values were found in samples collected from surface waters, due to the nature of the lighter freshwater to overlay the heavier saline waters. Coliform bacteria experience a rapid die-off rate in highly saline waters.

Dissolved oxygen samples collected from the bottom waters of stations AR7 and AR8 were generally well below the 5.0 mg/l minimum allowable for Class SB waters. The demand exerted by the bottom muds which have accumulated in the harbor over the years is responsible.

The lower BOD_5 results from 1975 confirm the fact that discharges of raw sewage and industrial wastes have been greatly reduced. This has also resulted in the overall reduction of nitrogen and phosphorus levels.

The quality of New Bedford Harbor has improved since 1971 but is still well below Class SB quality. It will likely remain less than SB quality for the near future due to the accumulation of toxic concentrations of heavy metals in the bottom muds. It is encouraging to note, however, that a comparison of the heavy metal concentrations in the bottom muds shows a decrease from 1971 to 1975. The concentrations remain at levels which are toxic to most benthic organisms, and dredging will be required for Inner New Bedford Harbor to meet SB criteria.

Segment 20 - Outer New Bedford Harbor - The overall quality of Outer New Bedford Harbor has also improved from 1971 to 1975. This is due to the construction of a primary wastewater treatment facility serving the City of New Bedford. The effluent is discharged to Buzzards Bay via a 3,300-foot-long outfall. The same outfall discharged untreated wastewater during the 1971 survey.

Station NB3, located in the vicinity of the plume from New Bedford's discharge, experienced a noticeable improvement in quality from 1971 to 1975. Due to the chlorinated effluent in 1975, the coliform bacteria concentrations decreased to levels acceptable for SA waters. The results from stations NB2 and NB5, which were common to both surveys, also indicate a general water quality improvement in the outer harbor.

New Bedford Outer Harbor, despite the low coliform bacteria levels, is considered to be of SC quality due to the magnitude of the pollutional load from New Bedford's wastewater treatment plant.

The problem with toxic concentrations of heavy metals in bottom muds is much less severe in the Outer Harbor. Extremely high concentrations of metals were found in the bottom muds collected at Station NB3 (New Bedford's discharge). At Pope Beach, Station NB5, the sediment consisted of only 0.6% organic material (dry weight basis), and the heavy metals concentrations were greatly reduced. Chromium, which was found in a concentration of 355 mg/kg at NB3, decreased to 43 mg/1 at NB5. While this is a definite improvement, the sediment at Station NB5 still represents an unsuitable environment for shellfish. The Outer Harbor has therefore been closed to shellfishing by the Division of Water Supply's Shellfish Section. Heavy metals continue to be discharged to the Outer Harbor from numerous metal-plating industries connected to the New Bedford Wastewater Treatment Plant, but their concentrations are considerably less due to each industry pretreating its effluent prior to discharge to the municipal system. The primary facility removes a considerable amount of the sludge formerly discharged to the harbor but removes very little of the metals which are in solution.

Segment 21 - Clark Cove - The 1971 New Bedford Harbor survey had one station (NB4) on Clark Cove. Its purpose was to assess the impact of sewage bypasses from the Rodney French Drive West Pumping Station. The frequency of these overflows had been greatly reduced by 1975; therefore the station location was changed to the most sensitive land use area, Jones Park Beach, located on the opposite side of the cove. In 1975, this station was labeled CC1.

Clark Cove has been classified as an SA body of water by the Division. There are twelve combined sewer overflows from New Bedford's collection system which periodically discharge to the cove. The intermittent nature of these wastewater flows results in widely varying water quality. No problems were found in Clark Cove during the 1971 or 1975 surveys. It is likely, however, that at times of heavy precipitation, raw sewage bypasses from the pumping station and the combined sewer overflows result in a temporarily lower quality. Due to these wastewater sources, Clark Cove has been closed to shellfishing by the Division of Water Supply's Shellfish Section. It is open to the taking of quahogs, which are less sensitive to polluted waters than other forms of shellfish.

The overall quality of Clark Cove is considered to be SB due to the temporary water quality problems resulting from discharges of untreated sewage.

Segment 22 - Apponagansett Bay - The 1975 Buzzards Bay surveys had one station on Apponagansett Bay (AP1) and one on Buttonwood Brook (AP2), which is a small tributary to the Bay.

The sampling results from Station AP2 in general indicate that Buttonwood Brook is not meeting Class B criteria. Nitrate-nitrogen averaged 1.2 mg/1 in July and 1.5 mg/1 in August, which indicates the possibility of failing septic systems upstream. The coliform bacteria concentrations were continually in violation of Class B criteria, with a maximum of 8,500 col/100 ml

found on August 19, 1975. These values further indicate a source of sewage to the brook.

While Buttonwood Brook is not grossly polluted, the concentrations of coliform bacteria found are in violation of Class B criteria and it is therefore considered to be of Class C quality. Buttonwood Brook, depsite its water quality problems, is not a major source of pollution to Apponagansett Bay due to its minimal flow.

Apponagansett Bay has been classified as SA waters by the Division of Water Pollution Control.

The community of Dartmouth has a recently completed secondary wastewater treatment plant which discharges via a deep ocean outfall to Buzzards Bay. Much of the area surrounding Apponagansett Bay remains to be sewered to the plant, and failing septic systems are a problem. As a result, 37 acres of the Inner Harbor have been closed to shellfishing by the Division of Water Supply.

Station AP1 was located on Gulf Hill Road at the inlet to a smaller bay within Apponagansett Bay. During the July survey, total coliform bacteria were present in concentrations acceptable to SA waters. In August, the total coliform bacteria concentrations increased to an average of 2,550 col/100 ml, which is in violation of Class SB standards. The source is believed to be failing septic systems in addition to discharges of sanitary waste from the numerous pleasure craft moored within the harbor. The nitrogen and phosphorus concentrations were slightly in excess of these found at "clean water" station AC1, further indicating sources of sanitary waste. These concentrations are still quite low, however, and the amount of biodegradable organic material is minimal, as indicated by the BOD_5 results which ranged from 0.0 mg/l to 2.2 mg/l.

It is difficult to assess the quality of an entire harbor on the basis of results from one sampling station. The high coliform bacteria counts found at Station AP1 indicate possible sources of sanitary waste to the Bay and, therefore, the Bay is believed overall to be of SB quality. The 37 acres which have been closed to shellfishing are also likely to be of SB quality and are suitable for swimming but have been closed due to the more stringent coliform bacteria requirements for the taking of shellfish.

Segment 23 - Paskamanset River - The 1975 Buzzards Bay surveys had four stations on the Paskamanset River which were located with the intent of assessing the impact of two sanitary landfills sited near the river's course. Station PA1, located at the outlet of Turner Pond, was chosen as a "clean water" station as there are no known sources of pollution upstream of this point.

The Paskamanset River at Station PA1 has a high concentration of organic material which is indicated by the average COD values of 112 mg/l in July and 99 mg/l in August. The BOD_5 results of 3.3 mg/l in July and 1.3 mg/l in August show that little of this material actually exerts an oxygen demand on the river.

Dissolved oxygen concentrations were continually found below the 5.0 mg/l minimum allowable for Class B waters. This is believed due to the large wetland areas forming the headwaters and the characteristically low D.O.

concentrations found in these waters. The unusually low pH values, which ranged from 4.5 to 4.9, are also characteristic of wetland waters. The stagnant nature of these waters affords little reaeration.

Due to the natural conditions producing the low dissolved oxygen values, the Paskamanset River at this point is considered to be meeting standards.

Station PA2 was initially intended to directly monitor possible leachates from the New Bedford Sanitary Landfill. This station was dropped from the July survey due to its inaccessibility. It was positioned on the main stem of the Paskamanset River, downstream of the New Bedford sanitary landfill at Route 6 in Dartmouth, for the August survey.

The results from the August survey at Station PA2 indicate that there are no problems with leachate from the landfill site. At Station PA1, the total coliform bacteria were well below Class B criteria. (A maximum of 100 col/100 ml were found in August.) At Station PA2, the total coliform bacteria concentrations for the August survey were in violation of Class B standards, averaging 1,600 col/100 ml. This is only slightly above the average allowable for Class B waters and could be the result of other unknown sources of pollution. The nutrients experienced only slight increases in concentration, while the COD values decreased, indicating no important input of organics from the landfill site.

Due to the reaeration between stations PA1 and PA2, the dissolved oxygen concentrations increased to an average of 5.3 mg/1 in August, with a minimum of 4.6 mg/1 recorded.

The coliform bacteria at Station PA2 are only slightly above the Class B allowable average and are not sufficient to consider the Paskamanset below Class B standards.

Stations PA3 and PA4 were located on the Paskamanset River above and below the Dartmouth sanitary landfill with the intent of assessing any leachate or runoff problems. There is little change in quality between stations PA2 and PA3, other than the continued recovery in dissolved oxygen concentrations.

Coliform bacteria were also found at Station PA3 in numbers slightly higher than expected, indicating possible failing septic systems. This problem appears to be minor, as there is no increase in the nutrients and COD values.

There are suspected leachate problems with the Dartmouth sanitary landfill. The results from stations PA3 and PA4 do not indicate any water quality problems resulting from the leachate, however. Overall, an improvement in quality is seen between stations PA3 and PA4 with reductions in coliform bacteria and nutrient concentrations. The Paskamanset River at this point is considered to be of Class B quality despite the dissolved oxygen concentrations which periodically fall below the 5.0 mg/1 minimum allowable for Class B streams. The Paskamanset River is by nature a slow-moving and meandering river which drains large wetland areas. As a result, reaeration is minimal and low dissolved oxygen concentrations are found along its entire length.

Segment 24 - Slocums River - Sampling Station PA4 marks the end of the Paskamanset River and the beginning of the Slocums River. The Slocums is tidal along its entire length and has no known pollution problems. It easily meets its SA classification and is open to shellfishing.

Segments 25 & 26 - Shingle Island River; Noquochoke Lake - The headwaters of the East Branch of the Westport River are formed by the Shingle Island and Copicut Rivers above Noquochoke Lake in Dartmouth.

A former Dartmouth sanitary landfill site is located near the course of the Shingle Island River in the vicinity of its headwaters. Sampling Station S11 was positioned downstream of the landfill site at Pine Island Road to assess any possible leachate or runoff problems. The results from both the July and August surveys indicate that the landfill is not a source of pollution to the Shingle Island River. The quality of the river at Station S11 is excellent and is well within Class B criteria.

Station WPE1 was located at the outlet of Noquochoke Lake, which is the actual beginning of the Westport River. Dissolved oxygen concentrations were occasionally found below the 5.0 mg/l minimum allowable for Class B waters during the July survey, but this was believed due to natural conditions. In all other respects, the Westport River at Station WPE1 is meeting Class B criteria.

Segment 27 - Westport River, East Branch, from outlet of Noquochoke Lake to Old County Road - Station WPE2 was located on the Westport River at Old County Road, two miles downstream from Station WPE1. Between the two stations, the Westport River receives a treated wastewater discharge from the Lincoln Park Amusement Company. There is also a moderate amount of development along the river in this area, and failing septic systems are a possibility.

At sampling Station WPE2, the Westport River does not meet Class B standards due to high counts of coliform bacteria which are probably the result of the previously mentioned sources. In July and August, the coliform bacteria averaged 3,300 and 5,000/100 ml, respectively. The ammonia- and nitrate-nitrogen concentrations increased noticeably, which would be expected downstream of a treated sanitary wastewater discharge. The phosphorus level did not increase, which may be due to the phosphorus removal employed at the Lincoln Park Wastewater Treatment Plant.

Station WPE2 marks the division between the upstream waters classified as B waters and the downstream, tidally influenced waters of SA classification.

Segment 28 - Westport River, East Branch, from Old County Road to river mouth - Station WPE3 was located on Hix Bridge Road on the Westport River and is 3.7 miles downstream from Station WPE2. The quality of the Westport River at this station is similar to that at WPE2, with the exception of the coliform bacteria counts, which decreased to nearly acceptable Class SA levels.

Station WPE4 was positioned on a small tributary to the Westport River which is in the vicinity of the Westport sanitary landfill. The results from both surveys indicate the landfill has no water quality impact on the Westport River.

The final station on the Westport River, East Branch, was located on the Route 88 bridge near the river's mouth. The results from this station and Station WPE3, located 4.1 miles upstream, indicate that this SA classified stretch of the river at times violated coliform bacteria requirements. During the July survey, the total coliform bacteria concentrations at Station WPE5 were well within SA requirements, with an average of 22 col/100 ml (low tide) while in August the concentration rose to 1000/100 ml (low tide), which is well above the median of 70/100 ml allowable for SA waters.

The increased coliform bacteria concentrations in August are possibly due to discharges of untreated sanitary waste from recreational and commercial watercraft near the river's mouth. Despite the higher than expected bacteria concentrations, the East Branch of the Westport River is considered to be of SA quality overall. The mere possibility of sanitary discharges, however, places the shellfishing beds in danger of closure.

Segment 29 - Westport River, West Branch - The 1975 Buzzards Bay survey had one sampling station (WPW1) on the West Branch of the Westport River at the United States Geological Survey gaging station in Tiverton, Rhode Island. The gaging station divides the upstream freshwater portion of the river located in Rhode Island from the downstream salt-water portion located primarily in Massachusetts.

There are no known wastewater discharges to the West Branch of the Westport River, but an average of 1700 coliform/100 ml were found in July. In August the average was 200/100 ml, which is well within Class B criteria. During both surveys, all other parameters were found to be within Class B criteria indicating this pollution source to be minor.

The tidal portion of the river has been classified as SA by the Division and is believed to be currently meeting this classification. Like the East Branch, this portion of the river is subject to possible discharges of untreated sanitary waste from commercial and pleasure craft. Both the East and West Branches of the Westport River are high-quality shellfishing areas, but the possibility of sanitary discharges in the vicinity of the beds places them in danger of closure.

TABLE 3

BUZZARDS BAY BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Buttermilk Bay	---	---	---	SA	SA
2	Onset Bay	---	---	---	SA	SA
3	Agawam River	Above Wareham STP	Above 2.0	---	B	B
3a	Agawam River	Below Wareham STP	2.0-0.0	2.0	B	B
4	Wankinco River	Entire length	---	---	B	B
5	Wareham River	Entire length	---	---	SB	SA
6	Weweantic River	Above outlet of Horseshoe Pond, Wareham	Above 4.1	---	B	B
7	Weweantic River	Outlet, Horseshoe Pond, to the mouth, Wareham-Marion	4.4-0.0	4.4	SA	SA
8	Sippican River	Above County Road, Marion-Wareham	Above 2.1	---	B	B
9	Sippican River	From County Road, Marion-Wareham, to mouth, Marion-Wareham	2.1-0.0	2.1	SA	SA
10	Sippican Harbor	---	---	---	SA	SA
11	Aucoot Cove	---	---	---	SA	SA
12	Mattapoisett River	Entire length	---	---	B	B
13	Mattapoisett Harbor	---	---	---	SA	SA
14	Nasketucket Bay	---	---	---	SA	SA

TABLE 3 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
15	New Bedford Reservoir	Acushnet	Above 8.2	---	B	B
16	Acushnet River	From outlet, New Bedford Reservoir, to Hamlin Road, Acushnet-New Bedford	8.2-5.5	2.7	B	B
17	Acushnet River	From Hamlin Road to Main Street, Acushnet-New Bedford	5.5-4.5	1.0	C	B
18	Acushnet River	From Main Street to Route 6 Acushnet-New Bedford	4.5-1.2	3.3	U	SB
19	Inner New Bedford Harbor		1.2-0.0	1.2	U	SB
20	Outer New Bedford Harbor		---	---	SC	SA
21	Clark Cove	New Bedford-Dartmouth	---	---	SB	SA
22	Apponagansett Bay	Dartmouth	---	---	SB	SA
23	Paskamanset River	Dartmouth-New Bedford	13.6-4.0	9.6	B	B
24	Slocums River	Dartmouth	4.0-0.0	4.0	SA	SA
25	Shingle Island River	Dartmouth	Above 14.2	---	B	B
26	Noquochoke Lake	Dartmouth	14.2-12.0	2.2	B	B
27	Westport River, East Branch	From the outlet of Noquochoke Lake, Dartmouth, to Old County Road, Westport	12.0-10.0	2.0	C	B
28	Westport River, East Branch	From Old County Road, Westport to the mouth, Westport	10.0-0.0	10	SA	SA

TABLE 3 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
29	Westport River, West Branch	Entire lenth	---	---	SA	SA

Total Miles of Class SA - 20.5
Total Miles of Class B - 16.5
Total Miles of Class C - 3.0
Total Miles of Unsatisfactory Conditions - 3.3

LAKES AND PONDS

There are 162 lakes and ponds in the Buzzards Bay Basin, of which only one--White Island Pond--has been surveyed by the Division.

Inventory

Buzzards Bay Basin:

Number of lakes and ponds	162
Surface area of lakes and ponds (in acres)	6,224
Number of lakes and ponds greater than 10 acres	115
Surface area of lakes and ponds greater than 10 acres	5,948
Number of officially recognized Great Ponds	16
Surface area of officially recognized Great Ponds (in acres)	1,937

Classification

Name	Location	Severity Points	Stratified/ Unstratified
White Island Pond	Plymouth/Wareham	7	U

IV - CAPE COD DRAINAGE BASIN

Cape Cod consists of 15 towns with a permanent population of 97,000. Its total area is 410 square miles, of which 17 square miles are water. The basin lacks long rivers and streams. The Herring River, which is the Cape's longest river, is only six miles long.

The Cape's soil is composed of unconsolidated glacial material such as sand, gravel and boulders deposited during the Ice Age. These deposits are found at various depths throughout the Cape, with a maximum depth of approximately 500 feet below sea level. Beaches were formed as a result of the melting ice releasing the debris (clay, silt, sand and boulders) it held and the action of the ocean.

Although there are water quality problem areas on the Cape, the vast majority of the coastal waters are clean. Of the approximately 12,600 acres of productive shellfish, 350 acres, or 3%, are closed, with 97% meeting their assigned classification. Also, areas not meeting the strict standards for open shellfishing are of sufficiently high quality to permit swimming. Therefore, the greatest effort must be expended in protecting clean waters, while limited efforts are needed in correcting as yet minor problems.

In general, small individual discharges account for the high bacterial concentrations in most of the closed areas. In Barnstable, the presence of an overflow pipe, which is activated at times of excessively high flows, requires the closure of eight acres. From time-to-time other areas have been temporarily closed. An oil spill in the Wild Harbor area of Falmouth accounted for the closure of a large area. The area is slowly being reopened, a portion at a time. Two areas were closed when mercury concentrations were found to exceed interim guideline levels. Anti-fouling paint in boat yards was the suspected source. Such paints have been phased out, and both areas have improved to the point that they should be open again soon.

The high quality of the coastal waters is matched by that of the surface and ground waters. The groundwater system, which expresses itself at the surface in ponds, is the most important freshwater resource on the Cape. Groundwater is the water supply source for all drinking water on Cape Cod and is also the eventual receiving water for the discharge from the few municipal and other treatment plants which now exist along with all the individual home disposal systems.

Some saltwater intrusion of groundwater has occurred in the North Truro-Provincetown area dating back to the 1930's and some areas have high concentrations of iron and manganese in the groundwater. These latter two constituents present a problem in water supplies because of staining and can necessitate treatment for their removal if present in sufficient quantities. These substances originate from natural groundwater processes.

Intensive Water Quality Surveys

The Cape Cod Basin was first sampled under the Divisions's monitoring program in the summer of 1976. The program consisted of samples collected on June 8-10, July 19-22, and August 31-September 1. A total of over 300 stations

were included in the survey, with most of these located in the numerous bays and estuaries on Cape Cod. The information collected proved the waters of Cape Cod to be of the highest quality of any in the state. There were few areas where violations of standards did occur, but these were mostly coliform bacteria and not of major consequence. The next scheduled water quality survey will be in 1981. The results of the 1976 survey can be found in the Cape Cod Water Quality and Wastewater Discharge Data 1976.

Compliance Monitoring

Discharges to the waters of the Cape Cod Basin have been sampled for the years 1975-76, 1976-77, and 1977-78. There are 19 discharges on Cape Cod; six of these are to groundwater and the remaining 13 are to surface waters. The results of these surveys can be found in the Cape Cod Water Quality and Wastewater Discharge Data 1976.

Basin Segmentation

To quantify the water quality problems in each area so that they may be compared, the water courses are first segmented. Major geographic features such as harbors and bays constitute segments. In general, a segment represents a portion of the whole waterbody which is, or would be affected by a discharge in the area.

LAKES AND PONDS

Although there are only a few small freshwater streams, ponds and lakes are abundant on Cape Cod. Most ponds are relics from the last period of glaciation which ended approximately 15,000 years ago. The ponds are often the result of the depressions intersecting the groundwater table.

Existing information on the ponds has been compiled through the efforts of the the University of Massachusetts. The Division's lake study program has not as yet begun investigations of ponds on the Cape, but some baseline data has been collected under the auspices of the Cape Cod "208" Study. During the study, one hundred and fifty-one lakes and ponds were sampled over the course of a week. Thirty of these were then chosen for intensive follow-up study. The results of this work have been published in the Commission's Areawide Wastewater Management Study.

There have been no baseline or intensive water quality studies on lakes and ponds in the Cape Cod Drainage by the Division. Future surveys are planned for several waterbodies including Johns Pond in Mashpee; Upper Mill Pond, Cliff Pond, Seymour Pond, Sheep Pond, and Walker Pond in Brewster; Long Pond in Brewster and Harwich; Hinkley Pond in Harwich; Aschunet Pond, Long Pond, and Coonamessett Pond in Falmouth and Mashpee; the Mashpee and Wakeby Ponds complex in Mashpee and Sandwich; Lawrence Pond and Peters Pond in Sandwich; Chequaquet Lake, Hamblin Pond, Mystic Lake, and Middle Pond in Barnstable. A timetable for this work has not been planned as of this writing.

Inventory

Number of lakes and ponds	353
Surface area of lakes and ponds(acres)	11,711
Number of lakes and ponds greater than 10 acres	206
Surface area of lakes and ponds greater than 10 acres	10,922
Number of officially recognized Great Ponds	54
Surface area of officially recognized Great Ponds (acres)	6,073

TABLE 4

CAPE COD BASIN

CLASSIFICATION AND CONDITION

SEGMENT NO	DESCRIPTION	PRESENT CONDITION	CLASSIFICATION	COMMENT
64A	Cape Cod Canal, Sandwich	SB	SB	Heavy oil tanker & pleasure boat traffic, stormwater runoff
65	Mill Creek - Sandwich	U	SA	Closed to shellfishing, low D.O.
66	Dock Creek - Sandwich	SA	SA	
67	Old Harbor Creek - Sandwich	SA	SA	
68	Scorton Creek - Sandwich	SA	SA	
69	Barnstable Harbor -	U	SA	Closed to shellfishing; failing septic systems
70	Chase Garden Creek - Yarmouth	SA	SA	
71	Sesuit Creek - Dennis	SA	SA	
72	Quivett Creek - Brewster & Dennis	SA	SA	
73	Namskaket Creek - Orleans	SA	SA	
74	Little Namskaket Creek - Orleans	SA	SA	
75	Rock Harbor Creek - Eastham	SA	SA	
76	Boat Meadow River - Eastham	SA	SA	
77	Herring River - Eastham	SA	SA	
78	Wellfleet Harbor - Wellfleet	U	SA	Closed to shellfishing, private septic systems' wastes
79	Pamet River - Truro	SA	SA	Sporadic coliform violations
80	Provincetown Harbor - Provincetown	U	SA	Closed to shellfishing, receiving untreated municipal waste
82	Nauset Harbor - Orleans	SA	SA	

TABLE 4 (CONTINUED)

SEGMENT NO.	DESCRIPTION	PRESENT CONDITION	CLASSI-FICATION	COMMENT
83	Chatham Harbor - Chatham	SA	SA	
83A	Frostfish Creek - Chatham	SA	SA	
84	Stage Harbor - Chatham	SA	SA	
85	Buck Creek - Chatham	SA	SA	
86	Red River - Harwich	SA	SA	
86A	Wychmere Harbor - Harwich	SA	SA	Some sporadic coliform violations, heavy seasonal boating activity
86B	Allens Harbor - Harwich	SB	SB	" " "
87	Herring River - Harwich	U	SA	Closed to shellfishing
88	Swan Pond River - Harwich	SA	SA	
89	Bass River - Yarmouth-Dennis	SA	SA	Stormwater runoff
90	Parkers River - Yarmouth	SA	SA	
91	Lewis Bay - Yarmouth	SA	SA	
91A	Lewis Bay - Barnstable	SA	SA	Stormwater runoff
92	Hyannis Harbor - Barnstable	U	SA	Closed to shellfishing
93	Centerville Harbor - Barnstable	SA	SA	
94	Cotuit Bay - Barnstable	SA	SA	
95	Popponesset Bay - Mashpee	SA	SA	
96	Waquoit Bay - Falmouth	SA	SA	
97	Eel Pond - Falmouth	SA	SA	
98	Bournes Pond - Falmouth	SA	SA	
99	Green Pond - Falmouth	SA	SA	
100	Great Pond - Falmouth	SA	SA	
101	Little Pond - Falmouth	SA	SA	

TABLE 4 (CONTINUED)

SEGMENT NO.	DESCRIPTION	PRESENT CONDITION	CLASSI-FICATION	COMMENT
102	Falmouth Inner Harbor- Falmouth	SB	SB	Heavy seasonal boating activity
102A	Siders Pond - Falmouth	SA	SA	
103	Salt Pond - Falmouth	SA	SA	
104	Oyster Pond - Falmouth	SA	SA	
105	Little Harbor - Falmouth	U	SA	Seasonal shellfish closure
106	Great Harbor - Falmouth	U	SA	Municipal discharge
107	Eel Pond - Woods Hole	U	SA	Closed to shellfishing
108	Quisset Harbor - Falmouth	U	SA	Closed to shellfishing
109	Sippewissett - Falmouth	U	SA	Closed to shellfishing
110	West Falmouth Harbor - Falmouth	U	SA	Closed to shellfishing
111	Herring Brook - Falmouth	SA	SA	
112	Wild Harbor - Falmouth	SA	SA	
113	Megansett Harbor - Falmouth & Bourne	U	SA	Closed to shellfishing
114	Red Brook Harbor - Bourne	SA	SA	
115	Pocassett Harbor - Bourne	SA	SA	
116	Phinneys Harbor - Bourne	SA	SA	
116A	Cape Cod Canal - Bourne	SB	SB	

V - CHARLES RIVER BASIN

The Charles River is a coastal stream of about seventy miles in length (excluding the Charles Basin). In Dedham, approximately one-third of the stream flow of the Charles is diverted to the Neponset River via Mother Brook. Sometimes in low-flow periods, up to 15 MGD is diverted by the Metropolitan District Commission from the Sudbury Aqueduct to the Charles River.

A very flat gradient causes the Charles to meander extensively. On the main stem there are several ponds and some twenty dams. The latter, most of which are artifacts of a once flourishing water-powered milling industry, radically alter the hydraulic characteristics of the river, to the detriment of water quality.

The primary uses of the waters of the Charles River Basin include water supply, recreation, and waste assimilation. The Charles River supports a number of recreational uses, including boating, canoeing, fishing, and such bankside activities as hiking and picnicking. Swimming in the Charles River is no longer common, due to its polluted state.

The upper Charles River, along with three upper river tributaries, receives ten significant wastewater discharges. These include four municipalities, three institutions, and three industries. The three largest polluters are the Town of Milford, the Town of Franklin, and Cott Corporation in Millis. There are no significant wastewater discharges in the Middle and Lower Watershed, although a number of very small cooling water discharges are scattered through the entire Charles River Basin.

Urban stormwater runoff is a significant, but unquantified source of pollution in the Charles River Basin. Other non-point sources of pollution include sand and gravel mining operations, poorly located sanitary landfills, old town dumps, and the use of road de-icing salts. Although there are no combined sewer systems within the basin, infiltration and inflow cause sewer overflows in Milford and Waltham and in the Middle Watershed communities connected to the MDC's Wellesley-Framingham interceptor system.

As a result of the wastewater discharges on the Upper Charles and pollution from urban runoff and other land use-related sources, the Charles River is presently highly enriched with organic wastes and inorganic nutrients and is subject to bacterial contamination. Also, other surface waters of the watershed, as well as the groundwater in some areas, are of very low quality.

Water Quality Surveys

The Charles River was last surveyed intensively by the Division in 1973. Extensive chemical and biological data were obtained concurrently with stream flow data. The water quality surveys included the main stem, Mine Brook, Stop River and single stations on each of several other important tributaries, among which was Sugar Brook in Millis. The data from the above surveys are documented in The Charles River 1973 Part A Water Quality Data.

The Division also accomplished various wastewater discharge surveys for the Charles River Basin. The most recent discharge survey was conducted in 1977. Chemical data were obtained for the major discharges of the basin along with flow measurements or estimates. The results of this survey were published by the Division as The Charles River 1977 Part B Wastewater Discharge Data.

Basin Segmentation

The Charles River, the Charles Basin, and three tributaries presently receiving significant wastewater discharges are segmented as shown in Table 5. The segmentation is determined by points of present or planned major wastewater discharges and by changes in future use classification. There are ten main-stem segments, two for Mine Brook, three for Stop River, and one for Sugar Brook.

In addition, Table 5 lists the future use classification in accordance with the present water quality standards and the present condition based on the 1973 water quality survey. A more complete summary of the present condition of each segment is given below.

Present Conditions

Segment 1- Source to Dilla Street, Milford - Water of this segment, which includes public water supply for the Town of Milford (Echo Lake), is of uniformly high quality, although the sampling at Dilla Street yielded total coliform levels apparently in violation of the Class A criterion. However, during the Division's 1973 surveys, a compositing technique for coliform samples was used; this technique was subsequently discarded because of the likelihood of sample contamination.

Segment 2 - Dilla Street to Main Street, Milford - This segment mostly comprises Cedar Swamp Pond, Milford, a shallow, eutrophic impoundment. This pond is choked with rooted aquatic weeds and exhibits high algae levels. D.O. concentrations are at the same time very low (minimum less than 2.0 mg/1, average less than 5.0 mg/1), indicating organic pollution also. Nutrient concentrations are moderately high. Due to infiltration/inflow, this segment is subject to sewer overflows/bypasses from Milford. Other sources of pollution are urban runoff and the old Milford dump located on the bank of the pond. There were formerly a few minor industrial discharges here.

Segment 3 - Main Street to Milford STP - Excessive algae, low minimum D.O. (less than 2.0 mg/1), and high nutrient concentrations characterize this segment. Milford's sewer system has overflows/bypasses affecting this segment. In Hopedale, Farrar & Carty, Inc., operates a sanitary landfill located by the floodplain of the Charles.

Segment 4 - Milford STP to Mine Brook, Franklin - This is one of the three most severely polluted segments in the Charles River Basin. Below the Milford STP are encountered depressed D.O. (minimum less than 1.0 mg/1), toxic ammonia concentrations (as high as 6.9 mg/1 as N), extremely high

nutrient concentrations (nitrate-nitrogen greater than 2.0 mg/l, total phosphorus as high as 5.0 mg/l), and bacterial contamination. This segment is subject to algal blooms and nuisance duckweed growths (both observed in Box Pond, Bellingham, in 1973). Nitrification in this segment is probable. In addition to the Milford STP, the Division's regional engineer indicates that problems with subsurface disposal systems in North Bellingham are not uncommon.

Segment 5 - Mine Brook to Populatic Pond outlet - Pollution of this segment is primarily from the Franklin STP, entering the main stem via Mine Brook. D.O. levels are depressed, but remain above 2.0 mg/l. Nutrient concentrations are high, and algal blooms occur. Other pollution sources in this segment are subsurface disposal systems in the Shepards Brook area of Franklin, Medway's Broad Street sewer (discharging into Great Black Swamp), and urban runoff. There is also a minor discharge from Your Laundry in Medway.

Segment 6 - Populatic Pond outlet to Stop River, Medfield - Having no point sources and only a sparsely developed local drainage area, this segment is not severely polluted. D.O. levels are moderately depressed, and nutrient concentrations remain fairly high. Pollution from subsurface disposal systems in Medfield is documented.

Segment 7 - Stop River, Medfield, to Sugar Brook, Millis - Nutrient and D.O. concentrations indicate moderate pollution in this segment. Pollution sources include subsurface disposal systems in Medfield, point and non-point sources entering via the Stop River, and other non-point sources.

Segment 8 - Sugar Brook to Bridge Street, Dover - In this segment, algal levels are fairly high; nevertheless, D.O. levels are depressed (averaging less than 5.0 mg/l). Also, bacterial contamination occurs. (Species of Salmonella were isolated here by FWPCA in 1967.) Nutrient concentrations are comparable to those in Segments 6 & 7. The major pollution sources enter via Sugar Brook; the Medfield State Hospital and the newly constructed Medfield STP also contribute pollutants. In Holliston, subsurface disposal systems and a metal finishing industry, Lane Corporation, are pollution sources for Bogastow Brook, a tributary to Segment 8.

Segment 9 - Bridge Street to South Natick Dam - The condition of this segment is similar to that of Segment 8 but with slightly higher D.O. concentrations (averaging greater than 5.0 mg/l), partly due to higher algal productivity. There are no point sources of pollution in this segment.

Segment 10 - South Natick Dam to Watertown Dam - The Middle and Lower Charles River, which comprise this segment, exhibit high algal productivity, moderately depressed D.O. levels, bacterial contamination, occasional instances of oil pollution, widespread litter and debris, and locally severe water quality degradation in the vicinity of several old landfill (dump) sites, notably in Newton and Waltham. There are no significant wastewater discharges in this segment. An important source of algal nutrients appears to be the upstream point sources. However, sources within this segment do contribute significant nutrient and organic waste loads. These include sewer overflows/bypasses in Waltham and the Middle Watershed; urban runoff; and, at least in portions of Wellesley, Natick, and Weston lying in the Morses Pond watershed, subsurface disposal systems. Mishaps of various kinds at industrial sites have commonly caused oil spills and similar transient problems.

Segment 11 - Mine Brook, source to Franklin STP - This segment is generally of high quality. The Class B, D.O. criterion is satisfied. Moderately high nutrient levels occur, but algal activity is not excessive.

Segment 12 - Mine Brook, Franklin STP to confluence - This is one of the three most severely polluted segments in the basin. Very low D.O. levels (typically less than 1.0 mg/1), bacterial contamination, ammonia toxicity (concentrations higher than 4.0 mg/1), and unnatural color are found in this reach. The primary source of pollution is the Franklin STP; note that this facility has been renovated since the 1973 survey, at which time it was operating at a low level of efficiency. The source of color in this segment is industrial dyeing wastes, discharged by the Franklin STP. Perhaps due to light limitation caused by this color, there is very little growth of algae in this segment.

Segment 13 - Stop River, source to Pondville State Hospital - This headwater segment is of slightly degraded quality, probably as a result of organic matter originating from wetland runoff. D.O. does not meet the Class B criterion, although the minimum exceeds 5.0 mg/1. Nutrient concentrations are moderately high.

Segment 14 - Stop River, Pondville State Hospital to Norfolk-Walpole MCI - D.O. concentrations are depressed in this segment (minimum less than 1.0 mg/1). Nutrient levels differ only slightly from those in Segment 13. Both the Pondville State Hospital and the Wrentham State School (via a small, marshy tributary) discharge to this segment. However, data indicate that the major contribution of nutrients and organic matter is from non-point sources. Natural drainage from adjacent wetlands, which are extensive in this segment, is probably the main contributor of these substances.

Segment 15 - Stop River, Norfolk-Walpole MCI to confluence - This reach exhibits depressed D.O. levels (averaging less than 5.0 mg/1) and moderately high nutrient concentrations. Discharging to this segment is the treatment facility of the Norfolk and Walpole MCI. But here again, non-point sources, and in particular wetland drainage, are indicated as the major contributors of organic matter and nutrients.

Segment 16 - Sugar Brook, Route 109, Millis, to confluence - This segment encompasses virtually all of Sugar Brook, a small tributary draining less than one square mile. It is the most severely polluted segment in the basin. At Route 109, National Can Corp. and Cott Corp. discharge wastewaters to the brook, and the Millis STP discharges to the brook further downstream. In this brook occur anaerobic conditions, ammonia toxicity (concentrations as high as 8.4 mg/1), extremely high total phosphorus concentrations (above 4.0 mg/1), extremely low pH (as low as 2.6), bacterial contamination, sludge deposits, and offensive odors. The sole use of this brook has for many years been the conveyance of wastes. The Millis municipal sanitary landfill is also located in this tiny sub-watershed.

Segment 17 - Watertown Dam to Charles River Dam - The Charles Basin, located in Metropolitan Boston is an 8.6-mile-long impoundment of the Charles River. The main sources of pollution in the basin are combined storm and sanitary sewer overflows. Other sources are those passed on by the Charles itself and from urban runoff. Sludge deposits (a secondary effect of combined sewer overflows) induce anaerobic conditions in the stagnant saline bottom waters. High coliform bacteria counts seem to be the major obstacles preventing improved water quality in the basin.

TABLE 5

CHARLES RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Charles River	Source to Dilla St., Milford	Above 76.5	1.0	A	A
2	Charles River	From Dilla St. to Main St., Milford	76.5-75.2	1.3	U	B
3	Charles River	From Main St. to Milford STP	75.2-73.4	1.8	U	B1
4	Charles River	From Milford STP to Mine Brook	73.4-63.1	10.3	U	B1
5	Charles River	From Mine Brook to outlet of Populatic Pond	63.1-58.9	3.2	C1	B1
6	Charles River	From outlet of Populatic Pond to Stop River	58.9-51.8	7.1	C1	B1
7	Charles River	From Stop River to Sugar Brook	51.8-49.8	2.0	C1	B1
8	Charles River	From Sugar Brook to Bridge St.,Dover	49.8-44.6	5.2	C1	B1
9	Charles River	From Bridge St., Dover, to South Natick Dam	44.6-41.1	3.5	C1	B
10	Charles River	From South Natick Dam to Watertown Dam	41.1-9.8	31.3	C	B
11	Mine Brook	Source to Franklin STP	Above 4.1	0.4	B	B
12	Mine Brook	Franklin STP to confluence	4.1-0.0	4.1	U	B
13	Stop River	Source to Pondville State Hospital	Above 7.8	0.2	B1	B

TABLE 5 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
14	Stop River	From Pondville State Hospital to Norfolk-Walpole MCI	7.8-4.0	3.8	U	B
15	Stop River	From Norfolk-Walpole MCI to confluence	4.0-0.0	4.0	U	B
16	Sugar Brook	From Route 109, Millis to confluence	1.6-0.0	1.6	U	B
17	Charles River Basin	From Watertown Dam to Charles River Dam, Boston Harbor, Boston	9.8-0.0	9.8	U	C

Total Miles of Class A - 1.0
Total Miles of Class B - 0.4
Total Miles of Class B1 - 0.2
Total Miles of Class C - 31.3
Total Miles of Class C1 - 25.0
Total Miles of Unsatisfactory Conditions - 31.8

LAKES AND PONDS

An intensive, year-long study was conducted in 1974 on Lake Pearl, Wrentham. The Division has published the findings of this study in a report entitled The Lake Pearl Water Quality Study 1974-1975. In addition, baseline surveys (one-time sampling) were performed on Farm Pond in Sherborn and Morses Pond in Natick/Wellesley.

Inventory

Number of lakes and ponds	141
Surface area of lakes and ponds (in acres)	3,821
Number of lakes and ponds greater than 10 acres	67
Surface area of lake and ponds greater than 10 acres	3,479
Number of officially recognized Great Ponds	14
Surface area of officially recognized Great Ponds (in acres)	1,032

Classification

Name		Severity Points	Stratified/ Unstratified
Lake Pearl	Wrentham	10	S
Farm Pond	Sherborn	2	S
Morses Pond	Natick/Wellesley	7	U

VI - CHICOPEE RIVER BASIN

The Chicopee River Basin covers an area of over 720 square miles in central Massachusetts. All or part of 32 towns (1970 population 371,000) lie within the basin, with the majority of the population concentrated in the Springfield Metropolitan Area (1970 population 275,000). Generally, the remaining area typifies the image of rural New England countryside with rolling hills, woodlands, small ponds, and winding brooks.

The basin includes four major adjoining river systems--the Ware River, the Swift River, the Quaboag River, and the Chicopee River--which together contribute an average flow of about 1,200 cubic feet per second (775 million gallons per day) to the Connecticut River.

The Ware River is formed by the confluence of the east and west branches in Barre. The west branch drains a swamp in Hubbardston while the east branch, which carries the greater flow, originates in Rutland. From their confluence the Ware River flows generally southwest for a distance of 34 miles, dropping in elevation some 380 feet and draining an area of 219 sqaure miles. Classified A in its upper reaches, Ware River water is diverted by the Metropolitan District Commission to Quabbin Reservoir. Below the reservoir intake to just below Barre center the river is classified B and below this point, the river is classified C as it begins to receive domestic sewage from Barre, Hardwick, and Ware; and industrial discharges from Barre, Ware, and Palmer. Also, three major impoundments impede its progress in Hardwick, Ware, and Palmer. The river joins the Quaboag River at Three Rivers in Palmer.

The three upper branches of the Swift River flow into Quabbin Reservoir, a major component of the water supply of Metropolitan Boston. This was formed by the construction of Winsor Dam which now controls the upper 186 square miles of drainage area of the Swift. Below Quabbin, the largest inland body of water in Massachusetts, the Swift River continues in a southerly direction for 10 miles until its confluence with the Ware River less than a mile above Three Rivers and drains an additional 30 square miles. Above Winsor Dam the Swift River is classified A and below the dam it is classified B.

The Quaboag River flows in a southwesterly direction for over 37 miles until it joins the Ware River at Three Rivers. Along this course the elevation drops some 650 feet and the river is known first from its source in Spencer to the outlet of Lake Lashaway in East Brookfield as the Seven Mile River, and then as the East Brookfield River until it enters Quaboag Pond a scant two miles downstream. Emerging from Quaboag Pond in a flat swampy area, the Quaboag gathers flow and velocity encountering only one small impoundment in West Warren before it joins the Ware River. The river drains 210 square miles and is classified B, except for a few reservoirs on its tributaries which are classified A. The Quaboag receives domestic discharges from Spencer and the Brookfields, as well as Warren and Palmer. Small industrial discharges are located in Brookfield, Warren, and Palmer.

The confluence of the Ware and Quaboag rivers forms the Chicopee River which continues 18 miles through the more heavily populated and industrialized portion of the basin and over a series of dams, some of which can regulate the flow. The Chicopee River is classified C and receives heavy domestic and industrial discharges along its entire path, until it joins the Connecticut River in Chicopee.

Water Quality Surveys

During the summer of 1972, the Massachusetts Division of Water Pollution Control and the United States Environmental Protection Agency combined their efforts for a comprehensive water quality survey of the Chicopee River Basin. In July of 1974 the Division of Water Pollution Control conducted another similar study of the basin as part of a continuing water quality monitoring and analyzing process carried on by the Massachusetts Water Resources Commission.

The 1972 survey included 24 sampling stations that were sampled four times daily on August 29 and 31. In 1974 each of 40 stations was sampled six times daily on July 16 and 18.

Results of these surveys have been published in The Chicopee River Basin, Part A 1972 and 1974 Water Quality Data by the Massachusetts Division of Water Pollution Control.

In May 1977 a "mini" survey was conducted on the Seven Mile River, East Brookfield River, and Dunn Brook in an attempt to determine if advanced waste water treatment would be required at the Spencer and North Brookfield Sewage Treatment Plants.

Nine stations were sampled over a three-day period. A total of 24 24-hour composites and nine coliform samples were sent to the Lawrence Experiment Station for analysis. Dissolved oxygen and temperature were recorded in the field. In addition, 24-hour composites were taken of the effluent from the Spencer and North Brookfield Sewage Treatment Plants during the same three-day period.

Results of this survey will appear in a forthcoming report entitled Chicopee River Basin Part A to be published by the Division of Water Pollution Control.

A wastewater discharge survey was carried out in 1976 and sampled 14 separate discharges to the Ware, Quaboag, and Chicopee River and several tributaries. The results of this survey are found in The Chicopee River Basin 1976 Part B, Wastewater Discharge Data.

Basin Segmentation

The major streams of the Chicopee River Basin include Dunn Brook and the Chicopee, Ware, Prince, Swift, Seven Mile, East Brookfield, and Quaboag rivers. These streams have been divided into segments to better identify specific areas where problems may exist.

Segments have been defined by natural and man-made boundaries such as dams, falls, confluences, and sewage treatment plants. Only one stream, the Prince River, consists of one entire segment. The remaining eight streams are all segmented by one, or more, of the above boundary conditions.

The following Table 6 defines each segment's boundaries as to geographical location, river mile points, and length in miles. It also lists the present condition of each segment and the future use classification according to the present water quality standards. A more complete description by segment follows this table.

TABLE 6

CHICOPEE RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Ware River	Above MDC intake	Above 29.1	4.9	A	A
2	Ware River	MDC intake to South Barre	29.1-27.3	1.8	B	B
3	Ware River	South Barre to Prince River	27.3-26.4	0.9	C	B
4	Ware River	Prince River to Wheelwright Dam	26.4-23.3	3.1	C	C
5	Ware River	Wheelwright Dam to Hardwick STP	23.3-15.6	7.7	C	C
6	Ware River	Hardwick STP to Ware Dam	15.6-12.2	3.4	C	C
7	Ware River	Ware Dam to Gibbs Crossing	12.2-8.8	3.4	U	C
8	Ware River	Gibbs Crossing to Thorndike Dam	8.8-3.2	5.6	U	C
9	Ware River	Thorndike Dam	3.2-0.0	3.2	U	C
10	Prince River	Entire length	8.4-0.0	8.4	B	B
11	Swift River	Above Winsor Dam	Above 9.8	--	A	A
12	Swift River	Winsor Dam to Bondsville	9.8-4.4	5.4	B	B
13	Swift River	Bondsville to confluence	4.4-0.0	4.4	C	B
14	Seven Mile River	Above Spencer STP	Above 2.4	7.1	B	B
15	Seven Mile River	Spencer STP to confluence	2.4-0.0	2.4	U	B
16	East Brookfield River	Source to Quaboag Pond	1.7-0.0	1.7	C	B
17	Quaboag River	Above Route 67 bridge	24.9-19.2	5.7	B	B

TABLE 6 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
18	Quaboag River	Route 67 bridge to Warren STP	19.2-13.1	6.1	B	B
19	Quaboag River	Warren STP to Route 32 bridge	13.1-5.1	8.0	B	B
20	Quaboag River	Route 32 bridge to confluence	5.1-0.0	5.1	C	B
21	Dunn Brook	Above North Brookfield STP	Above 3.3	1.0	B	B
22	Dunn Brook	North Brookfield STP to confluence	3.3-0.0	3.3	U	B
23	Chicopee Brook	Entire length	---	1.0	B	B
24	Chicopee River	To Red Bridge Dam	17.9-15.2	2.7	C	C
25	Chicopee River	Red Bridge Dam to Wilbraham STP	15.2-11.7	3.5	C	C
26	Chicopee River	Wilbraham STP to Ludlow Dam	11.7-9.3	2.4	C	C
27	Chicopee River	Ludlow Dam to Indian Orchard Dam	9.3-7.8	1.5	U	C
28	Chicopee River	Indian Orchard Dam to Chicopee Falls	7.8-3.0	4.8	U	C
29	Chicopee River	Chicopee Falls to confluence	3.0-0.0	3.0	U	C

Total Miles of Class A - 4.9
Total Miles of Class B - 44.5
Total Miles of Class C - 34.9
Total Miles of Unsatisfactory Conditions - 27.2

Present Conditions

Segment 1 - Ware River above MDC intake - The headwaters of the Ware River consist of a series of wetlands and marshes separated by short sections of rapids. The marshes can add a brownish color to the water, but D.O. values remain near saturation. Total coliform densities vary with runoff and stream temperatures can vary significantly, but these responses to natural conditions do not violate water quality standards. At the bottom of this segment, the MDC intake works diverts Ware River water to Quabbin Reservoir to be used eventually as drinking water.

Segment 2 - Ware River, MDC intake to South Barre - From the MDC intake works to the Village of South Barre, water quality conditions are much the same as in Segment 1. However, this segment has a B classification, permitting wider recreational uses of the stream, since it is no longer used for a public drinking water supply.

Segment 3 - Ware River, South Barre to Prince River - Below the Village of South Barre, Class B water quality criteria are violated by high coliform densities. A small section of South Barre is sewered to a septic tank at Barre Wool Combing which, in turn, discharges to the Ware River. The discharge is not large enough to create heavy oxygen demands on the stream, but the background nutrient levels rise slightly.

Segment 4 - Ware River, Prince River to Wheelwright Dam - The Ware River, from the confluence of the Prince River to the Wheelwright Dam, is classified C. This segment was once severely polluted by industrial wastes discharged from lagoons at Barry Wool Combing and transported to the Ware by the Prince River. The company recently began phasing out its operation in Barre, but there is still a small discharge from the lagoons. During the 1974 water quality survey this segment basically met Class C criteria except for one day when floating solids appeared in the impoundment and D.O. values fell below 5.0 mg/l during the morning hours. The discharge from the lagoons is believed responsible for this. In addition, total coliform densities were occasionally high due to carryover from Segment 3.

Segment 5 - Ware River, Wheelwright Dam to Hardwick STP - Sewage from the Village of Wheelwright is first passed through sand filters and then discharged directly to the Ware River below the Wheelwright Dam. The discharge is small and intermittent, and the Ware River receives no additional discharges until the Village of Gilbertville. The resulting water quality of the stream meets Class C criteria, but coliform densities are occasionally high due to the discharge of sewage.

Segment 6 - Ware River, Hardwick STP to Ware Dam - The Ware River previously received the discharge from combined sewers in the Village of Gilbertville. Downstream of the village, total coliform densities were continually high during the 1974 survey, but D.O. levels were not depleted because of the segment's high reaeration rates. Since the 1974 survey, a new wastewater treatment plant in the village has become operational, and a significant improvement in water quality is expected. Confirmation of this will be sought in the monitoring program and in the next intensive water quality survey of the basin.

In the impoundment below the Town of Ware, the D.O. fluctuated diurnally in response to the algal effect, but no violations of Class C criteria were observed in 1974.

Segment 7 - Ware River, Ware Dam to Gibbs Crossing - Below the Ware Dam the river passes through the industrial center of Ware and receives numerous discharges. Initially, the stream's D.O. is maintained by high reaeration rates, but the river is degraded by color and solids. Stream phosphorus concentrations rise at this point and take another substantial jump a short distance downstream when the river receives the effluent from the Ware STP. Below this point the nutrient-enriched waters show significant diurnal fluctuations and minimum D.O.'s often drop below 3.0 mg/1. The low D.O. and the general aesthetic degradation of the river make the present condition of this segment U.

Segment 8 - Ware River, Gibbs Crossing to Thorndike Dam - Although there are no new discharges introduced, a new segment is started at the Route 32 bridge at Gibbs Crossing. At this point the D.O. sag created by domestic and industrial wastes from the Town of Ware begins to level out and recover. From this point to the Thorndike Dam, the river slows and meanders through farm and pastureland. Solids settle out in this segment, and a secondary process of stream assimilation, nitrification, occurs. Within the segment there are occasional violations of D.O. and total coliform criteria. Survey data suggest that these violations are at least partially due to runoff from the surrounding farmland. In the impoundment in Thorndike, floating clumps of sludge and gas bubbles rising from the bottom near the dam were noted. Although the water is shallow, the bottom was not visible because of the water's turbidity. These results indicated that the impoundment provides for settling and decomposition of sewage and textile wastes from the Town of Ware. Nutrient concentrations are still high enough to sustain a significant algal population. In 1974, the average D.O. at this point was 6.8 mg/1, but concentrations often dropped below 5.0 mg/1 at night. The present condition of this segment borders between C and U, with its water quality problems largely stemming from carryover from Segment 7.

Segment 9 - Ware River, Thorndike Dam to confluence - Below the Thorndike Dam the Ware receives the discharge from Diamond International (a paper company) and small discharges of raw sewage from the Village of Thorndike. The industry contributes to high solids and BOD concentrations in the stream, and the sewage raises the total coliform counts. Decomposition in the impoundment fertilizes the stream with nitrate. The Ware River becomes choked with weeds in this segment. Diurnal fluctuations in combination with high BOD loadings contribute to violations in D.O. criteria during low flow conditions. These violations in criteria along with the eutrophication of the stream make the present condition of this segment unsatisfactory.

Segment 10 - Prince River - The Prince River was not sampled during the 1974 water quality survey, so specific violations of its B classification are not reported here. The river presently receives cooling water and a small amount of sanitary waste from the Charles G. Allen Company in Barre. Because the Prince River does not presently receive a municipal discharge, it is classified anti-degradation. The present discharges will have to be eliminated or provided with a high degree of treatment.

Segment 11 - Swift River above Winsor Dam - This segment consists of the upper three branches of the Swift River and Quabbin Reservoir. The waters are used for a public drinking water supply and recreational uses are restricted. There are no discharges into the segment and no known violations of water quality criteria.

Segment 12 - Swift River, Winsor Dam to Bondsville - Below Winsor Dam water temperatures fluctuate with releases from Quabbin Reservoir. These releases are from over 40 feet below the surface of the reservoir, and these waters can be as much as 15°F below surface water temperatures. Just below Winsor Dam the Swift River receives the discharge from the Charles L. McLaughlin Trout Hatchery. This discharge is high in suspended solids which quickly settle to the stream bed. Cold stream temperatures and high reaeration rates keep D.O. concentrations high. No known violations of Class B criteria occur; but the segment is classified as anti-degradation, demanding a high degree of treatment or elimination of the discharge.

Segment 13 - Swift River, Bondsville to confluence - In the Village of Bondsville, the Swift River receives discharges from combined sewers. The discharges are small and do not place an assimilative burden on the stream. However, the discharges do occasionally violate Class B total coliform bacteria criteria.

Segment 14 - Seven Mile River above Spencer STP - This segment consists of the upper reaches of the Seven Mile River above the confluence of the Cranberry River. There is a swampy section in this segment that adds color and lowers D.O. concentrations slightly, but no violations of Class B criteria occur.

Segment 15 - Seven Mile River, Spencer STP to confluence - In this segment the Cranberry River flows into the Seven Mile, bringing with it the effluent from the Spencer STP. The discharge is just upstream (about a tenth of a mile) from the mouth of the Cranberry River so that this tiny tributary is not segmented. The treatment plant offers a high degree of treatment (secondary plus sand filters), but the stream's meager flow severely limits its assimilative capacity. Carbonaceous demands are largely satisfied in the treatment process, but the nitrogen (in the form of ammonia) discharged by the plant is quickly oxidized in the stream. The nitrogenous demand coupled with diurnal fluctuations from the phosphorus-fertilized waters brought minimum D.O. values down to 3.9 mg/l during the 1974 survey. High instream concentrations of BOD, suspended solids, ammonia, and phosphorus reflect the poor dilution offered by the stream rather than an inefficient treatment plant. Therefore, this segment is water quality limited, requiring a high degree of treatment to achieve water quality standards.

Segment 16 - East Brookfield River, source to Quaboag Pond - As the Seven Mile River joins the West Brookfield River, nitrogenous oxygen demands are largely satisfied. In addition, the dilution increases the stream's assimilative capacity and decreases nutrient concentrations. However, D.O. concentrations still dip below 5.0 mg/l owing to diurnal fluctuations and violate Class B criteria. Because nutrients are still a problem, this segment, too, is water quality limited, for nutrient removal is needed to meet standards. This segment ends at the inlet to Quaboag Pond. Lake environments

require totally different sampling and analysis methods and therefore will not be discussed here. The results of a one-year intensive study on Quaboag Pond by this Division is available.

Segment 17 - Quaboag River above Route 67 bridge - The headwaters of the Quaboag River emerging from Quaboag Pond continue to respond more as a lake environment than as a flowing stream. For approximately six miles the river's elevation drops only a few feet, and the stream flow is sluggish and meandering. The surrounding area is marshland. The upper end of this segment receives the effluent from the North Brookfield STP via Dunn Brook. Although in-stream BOD values are low, by the end of the segment D.O. values dip below 3.0 mg/l. Swamps and marshy areas often have natural oxygen sinks, such as decaying vegetation. This fact coupled with the extremely low reaeration rates results in a low D.O. Even with no wastewater discharge, this segment might still have a low D.O. due to natural conditions.

Minimum D.O.'s in this segment occurred in coincidence with diurnal fluctuations, even though nutrient concentrations were low. This was not surprising since the segment acts, in some respects, more like standing water than flowing water, and standing water is more sensitive to small concentrations of nutrients.

Segment 18 - Quaboag River, Route 67 bridge to Warren STP - In West Brookfield, the Quaboag River turns southward and the gradient increases. Higher reaeration rates quickly replenish the stream's D.O. Total coliform densities slightly exceed Class B criteria. These are probably due to overland runoff, for there are no point sources of pollution in the area. Because this does not inhibit any present or anticipated future use of the segment, its present condition is given as B.

Segment 19 - Quaboag River, Warren STP to Route 32 bridge - The Quaboag River's gradient continues to increase in this segment and this portion of the stream is comprised mainly of rapids. The rocky bottom and high reaeration rates give this segment an excellent assimilative capacity. The small discharge from the Warren STP has little effect on instream BOD and D.O. measurements. Total coliform densities are, again, slightly higher than Class B criteria. In general, however, this segment's present condition is B.

Segment 20 - Quaboag River, Route 32 bridge to confluence - In its final five river miles, the Quaboag River receives numerous discharges from the towns of Palmer and Monson. Only under severe low flow conditions is the water's oxygen content affected, for reaeration rates are generally high. The combined sewer discharges contribute to high coliform densities that violate Class B criteria.

Segment 21 - Dunn Brook, above No. Brookfield STP - This segment consists of the headwaters of Dunn Brook. There are no known discharges in the segment and no known violations of Class B criteria.

Segment 22 - Dunn Brook, No. Brookfield STP to confluence - The North Brookfield STP discharges to Dunn Brook approximately three river miles above the confluence with the Quaboag River. The stream was last sampled during the 1972 survey, at which time D.O., total coliform, and total phosphorus concentrations violated Class B criteria. The stream's tiny size severely limits its assimilative capacity, and this segment is therefore water quality limited.

Segment 23 - Chicopee Brook - Chicopee Brook joins the Quaboag River about 4.5 miles above the Quaboag's mouth. The brook was not sampled during the previous intensive water quality surveys, but the water quality is monitored by this Division's Western Regional Office. The stream receives several discharges of cooling water and plating wastes from Zero Manufacturing, American Standard, and Dan Wesson Arms just downstream of Church Pond.

Segment 24 - Chicopee River to Red Bridge Dam - The Ware and Quaboag Rivers join in the Village of Three Rivers to form the Chicopee River. Initially, this river is wide and rapid with a good assimilative capacity. Small discharges from combined sewers in the Village of Three Rivers appear in the survey results as occasionally high total coliform densities. Two miles downstream, the river enters the Red Bridge impoundment. The impoundment maintains an algal population because residual concentrations of nutrients from the Ware and Quaboag Rivers are relatively high. D.O. concentrations in the impoundment remained high during the 1972 and 1974 water quality surveys, for the net effect of the algae was the supersaturation of water with dissolved oxygen. This portion of the segment can be considered more of a lake than a flowing stream, and lake monitoring techniques must be used to determine its water quality and the extent of eutrophication.

Segment 25 - Chocopee River, Red Bridge Dam to Wilbraham STP - Downstream of Red Bridge Dam the Chicopee River flows for over three miles with no point sources of pollution. Total coliform counts vary due to runoff and carryover from the previous segment, but average values collected during the 1974 survey were not high enough to constitute a violation of Class C standards.

Segment 26 - Chicopee River, Wilbraham to Ludlow Dam - A new sewage treatment facility discharges to the Chicopee River in the Town of Wilbraham. D.O. concentrations remain high because the discharge is small and highly treated. There were no violations of Class C criteria in this segment during the 1974 survey.

Segment 27 - Chicopee River, Ludlow Dam to Indian Orchard Dam - Below the Ludlow Dam the Chicopee receives several discharges from combined sewers as well as the discharge from the antiquated Ludlow STP. No stations were sampled in this segment during the 1974 water quality survey, but previous surveys showed high total coliform densities and some D.O. values below 5.0 mg/l in the Indian Orchard impoundment about a mile downstream of the Ludlow discharge.

Segment 28 - Chicopee River, Indian Orchard Dam to Chicopee Falls - This segment is the most grossly polluted segment in the entire Chicopee River Basin. In addition to combined sewer outfalls, the river receives large discharges from Monsanto Company's Bircham Bend and Springfield plants and the Indian Orchard STP (a primary treatment facility). The waters are odorous and highly colored with a variety of chemical and organic wastes. As the Chicopee River enters the swampy section above Chicopee Falls, D.O. values drop to zero. Total coliform densities and instream nutrient concentrations are also very high here.

Segment 29 - Chicopee Falls to confluence - Below Chicopee Falls, the Chicopee River continues to receive combined sewer discharges and industrial process water. The water quality remains severely degraded due to carryover from the previous segment, in addition to the effects from the new discharges. The only significant difference from the previous segment is that the stream's dissolved oxygen recovers considerably due to dam reaeration and a faster stream velocity.

LAKES AND PONDS

Within the Chicopee River Basin, there are 164 lakes and ponds which cover 31,723 acres. Six surveys--three intensive and three baseline--have been conducted in the basin. They are:

Intensive:

Name	Location	Year Surveyed
Quaboag Pond	Brookfield/E. Brookfield	1974-1975
Quacumquasit Pond	Brookfield/E. Brookfield	1974-1975
Lake Mattawa	Orange	1975-1976

Baseline:

Name	Location	Year Surveyed
Beaver Lake	Ware	1974
Lake Lashaway	Brookfield	1974
Wickaboag Pond	W. Brookfield	1974

To date, the only survey results published appear in The Quaboag and Quacumquasit Ponds Water Quality Study, 1974-1975.

Inventory

Number of lakes and ponds	164
Surface area of lakes and ponds (in acres)	31,723
Number of lakes and ponds greater than 10 acres	102
Surface area of lakes and ponds greater than 10 acres	31,382
Number of officially recognized Great Ponds	15
Surface area of officially recognized Great Ponds (in acres)	1,294

Name	Classification	Severity Points	Stratified/ Unstratified
Red Bridge Impoundment	Ludlow/Palmer/Wilbraham	15	S
Lake Lashaway	East Brookfield/West Brookfield	8	S
Quacumquasit Pond	Brookfield/East Brookfield Sturbridge	6	S
Wickaboag Pond	West Brookfield	7	U
Beaver Lake	Ware	5	U
Camp Putnam Pond	New Braintree	4	U
Quaboag Pond	Brookfield/East Brookfield	4	U

VII - CONNECTICUT RIVER BASIN

The Connecticut River begins in Canada and for most of its course north of Massachusetts serves as the boundary between New Hampshire and Vermont. The river flows essentially due south through Massachusetts from Bernardston and Northfield on the Vermont-New Hampshire line to Agawam and Longmeadow on the Connecticut state line. From here the Connecticut flows south through the State of Connecticut to Long Island Sound. In Massachusetts the Connecticut River Basin is bounded by the Housatonic and Hoosic drainage basins on the west, and by the French and Quinebaug and the Nashua drainage basins on the east. There are approximately 66 river miles in Massachusetts. The Connecticut River main stem has a drainage area of 650 square miles in Massachusetts. This area had a 1970 population of 500,000 people. Most of these are located in the metropolitan Springfield area. The four major tributaries to the Connecticut River in Massachusetts are the Millers, Deerfield, Chicopee, and Westfield rivers. Each of these has been dealt with in separate water quality management plans which have been published by this Division. When these four tributaries are added to the Connecticut River main stem, the drainage area in Massachusetts is 2949 square miles and the population is more than 650,000 people. The Connecticut River is the largest river in New England. The average flow at the Massachusetts-Connecticut state line is 16,180 cubic feet per second (cfs).

The Connecticut River in Massachusetts is divided into two entirely different sections by the Holyoke Dam. Above the dam, the river is relatively clean and is at, or near, Class B standards. Below the dam, the river is grossly polluted and violates most of the criteria for even a Class C classification. Recently completed secondary treatment facilities for Springfield and Chicopee and the secondary treatment facility currently under construction for Holyoke will alleviate these problems considerably. Combined sewer discharges from these cities will also have to be dealt with before the lower Connecticut will meet Class C standards.

Water Quality Surveys

In the summer of 1971 the Division conducted an intensive water quality survey on the lower Connecticut River (from the Holyoke Dam to the Massachusetts-Connecticut state line). This was a joint survey involving the Division and the Federal Environmental Protection Agency. The survey consisted of 24 hours of sampling for five consecutive days in August. Ten stations on the Connecticut River main stem were sampled and additional stations on the Westfield and Chicopee Rivers were also sampled. Photosynthesis data was obtained at all ten main stem stations. The results of this survey were published in a report entitled Connecticut River Survey-1971 Data Record on Water Quality and Time of Travel Study.

In the summer of 1973 the Division conducted an intensive water quality survey on the upper Connecticut River (from the Holyoke Dam to the New Hampshire-Massachusetts state line). This survey consisted of 24-hour sampling for three consecutive days during a week in August and a week in September. Photosynthesis data was obtained at five separate locations on the upper Connecticut River during each of these weeks. The results of this survey have been published in a report entitled Upper Connecticut River - 1973 Water Quality Survey Data.

In 1971 the Division awarded a contract to Tighe & Bond, Inc., Consulting Engineers, for the purpose of sampling all significant waste discharges in the Connecticut River Basin in Massachusetts. These discharges were sampled for a 24-hour period on each of three days. The results of this survey have been published in a report entitled Wastewater Discharge Survey: Connecticut River Basin.

The data contained in these three reports is discussed in the Connecticut River - 1973 Water Quality Analysis. This report was published in 1975. The report contains an analysis of the above noted data, as well as sections on the history of the Connecticut Basin, water supply, recreation, and a description of planning efforts being conducted in the basin.

All major wastewater discharges in the Connecticut Basin have been sampled annually since 1975. The most recent data can be found in a report entitled The Connecticut River Part B, 1977 Wastewater Discharge Data.

A major water quality survey will be carried out in the Connecticut River Basin during the summer of 1978.

Basin Segmentation

In order to define the present problems, the Connecticut River has been broken down into a number of segments. These segments are listed in Table 7. Along the main stem Connecticut River, a segment division occurs at each classification change, at each major municipal wastewater treatment facility and at the confluence with each major tributary. Bachelor Brook is segmented to Lampson Brook and Lampson Brook is segmented to the Belchertown State School discharge. Stony Brook is segmented to the Stony Brook Paper Company discharge. The four major tributaries of the Connecticut in Massachusetts are considered to be separate basins and are covered in other sections of this report. Table 7 also lists the present condition and future use classification for each segment. The future use classification is based on the present water quality standards, while the present condition is based on the results of the 1971 and 1973 water quality surveys.

Present Conditions

Segment 1 - Massachusetts-New Hampshire Line to Northfield Reservoir Intake - This segment meets all requirements for Class B criteria except for coliform. The levels for this parameter are quite high here. This station indicates the condition of the Connecticut River as it enters Massachusetts. Discharges of untreated and partially treated wastes into the Connecticut River and its tributaries in New Hampshire and Vermont are responsible for the high coliform levels in this segment.

Segment 2 - Northfield Intake to Millers River - This segment meets all Class B criteria except for coliform. The high coliform levels are carried over from segment one into this segment. The intake and discharge points for the Northfield pumped storage project are located at the top of this segment. To date no adverse effects on water quality have occurred as a result of the operation of this project.

Segment 3 - Millers River to Turners Falls Backwater - This segment meets all Class B criteria. The only major discharge into this segment is the waste

carried by the Millers River. This is heavily diluted by the much larger flows in the Connecticut River and does not have a significant effect on the water quality in this segment.

Segment 4 - Turners Falls Backwater to Turners Falls Dam - This is the pond backed up behind the Turners Falls Dam. The large volume of water in this segment serves to dilute the wastes which are carried into it from upstream segments. There are no direct discharges into this segment. The water quality here is at Class B levels.

Segment 5 - Turners Falls to Deerfield River - During the summer, most of the flow in the Connecticut River bypasses this segment. Water is diverted to the Turners Falls power canal at the start of this segment and flows back into the river near the end of this segment. Coliform levels in this reach exceed established Class B levels. The high coliform levels are caused by discharges into the Turners Falls Power canal from sewer overflows and storm drains located in the Village of Turners Falls.

Segment 6 - Deerfield River to South Deerfield Treatment Plant - This long segment meets all water quality criteria for a Class B stream.

Segment 7 - South Deerfield Sewage Treatment Plant to Amherst Outfall - This segment meets Class B criteria.

Segment 8 - Amherst Outfall to above the Oxbow - All Class B criteria with the exception of coliform levels are met in this segment. The badly overloaded Amherst Sewage Treatment Plant is the major contributor to this problem. Untreated domestic sewage from Hatfield is also discharged into this segment. Nutrient levels are high in this segment and a photosynthesis station located here in 1973 indicated that some photosynthetic activity occurred in this segment.

Segment 9 - Above Oxbow to below Oxbow - This small segment receives the discharge from the Northampton primary treatment facility. Consequently, coliform levels are very high in this segment. Nutrient levels also increase significantly in this segment. This segment meets Class B criteria except for coliform levels.

Segment 10 - Below Oxbow to South Hadley Backwater - The discharge from the Easthampton treatment facility enters this segment. Also the Northampton discharge affects this segment. Coliform levels are far above Class B criteria. Nutrients continue to be high. This segment meets all Class B criteria, except for coliform levels.

Segment 11 - South Hadley Backwater to South Hadley Dam - This segment is the pond behind the Holyoke Dam. At this time, the sewage discharges into this segment from Holyoke have been eliminated. However, sewer overflows from South Hadley discharge into this segment. Coliform levels are well above Class B criteria and nutrients remain high. In 1973 a major algal bloom occurred in this impoundment during the September water quality survey on the Connecticut River. This segment does not meet Class B criteria.

Segment 12 - South Hadley Dam to Holyoke Sewage Treatment Plant - In this segment, coliform levels jump into the hundreds of thousands, nutrients reach very high levels, levels of toxic metals become significant, BOD

levels increase significantly, and dissolved oxygen levels violate Class C criteria. Combined sewers from Holyoke and South Hadley, industrial discharges, and the effluent from the South Hadley primary sewage treatment plant all contribute to the degradation of the water quality in this segment. This segment does not meet Class C criteria.

Segment 13 - Holyoke Sewage Treatment Plant to Chicopee River - This segment receives the bulk of the combined sewer discharges from Holyoke and Chicopee. Also, the discharges from the Holyoke and Chicopee treatment facilities enter this segment. A number of major industrial discharges affect this segment also. Coliform levels remain high in this segment. Dissolved oxygen levels do not meet Class C criteria. Nutrients, oil, floating solids, and toxic metals all contribute to the degradation of the water quality in this segment. This segment is well below Class C criteria.

Segment 14 - Chicopee River to Springfield Sewage Treatment Plant - This segment is degraded by wastes carried to it from upstream waste discharges, and combined sewer overflows from Springfield and Chicopee further degrade the water quality in this segment. All significant water quality parameters indicate that this segment is severely polluted. This segment is well below Class C criteria.

Segment 15 - Springfield Sewage Treatment Plant to Westfield River - This short segment receives the discharge from the Springfield Regional Treatment Plant at Bondi Island. This has been recently upgraded to secondary treatment. The heated discharge from Northeast Utility's West Springfield generating station further degrades the water quality in this segment. Most significant water quality parameters increase to their highest levels on the Connecticut River in this segment and dissolved oxygen values decrease to levels well below Class C criteria. This segment obviously does not meet Class C criteria.

Segment 16 - Westfield River to Leonard Street - The water quality in this segment continued to be seriously degraded. This segment does not receive any additional waste discharges, but is affected by the major waste discharges into the segments above it. Coliform levels, nutrients, floating solids, and oil are all problems. In addition, dissolved oxygen levels are unacceptably low. This segment is well below Class C criteria.

Segment 17 - Leonard Street to Riverside Park - The upstream discharges continue to seriously degrade the water quality of the Connecticut River in this segment. All significant water quality parameters are at unacceptable levels in this segment. The water quality in this segment is well below Class C criteria.

Segment 18 - Riverside Park to Massachusetts-Connecticut State Line - The water quality in this segment begins to show improvement. However, it is still below Class C criteria. Dissolved oxygen levels continue to violate the C classification assigned to this segment. Nutrients, coliform levels, oil, and floating solids from upstream discharges all contribute to the degradation of the water quality in this segment. There are no known pollutional discharges into this segment.

Segment 19 - Bachelor Brook from the Connecticut River to Lampson Brook - This stream originates in Belchertown and flows through Granby and South Hadley to its confluence with the Connecticut River. The stream is not subject to discharges and fully meets Class B criteria.

Segment 20 - Lampson Brook from Forge Pond to George Hannum Street - The highly treated effluent from the Belchertown State School Sewage Treatment Plant is discharged into the upper portion of this segment. The discharge does not significantly lower the water quality of Lampson Brook. This segment meets Class B criteria.

Segment 21 - Stony Brook from the Connecticut River to Route 116 - Highly treated effluent from the Stony Brook Paper Company is discharged into the upper portion of this segment. This segment meets Class B criteria.

TABLE 7

CONNECTICUT RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFI-CATION
1	Connecticut River	Mass.-Vt.-N.H. state line to Northfield Reservoir intake	138.2-128.8	9.4	C	B
2	Connecticut River	Northfield intake to Millers River	128.8-127.7	1.1	C	B
3	Connecticut River	Millers Rivers to Turners Falls backwater	127.7-126.0	1.7	B	B
4	Connecticut River	Turners Falls backwater to Turners Falls Dam	126.0-123.8	2.2	B	B
5	Connecticut River	Turners Falls Dam to Deerfield River	123.8-120.5	3.3	C	B
6	Connecticut River	Deerfield River to South Deerfield STP	120.5-112.0	8.5	B	B
7	Connecticut River	South Deerfield STP to Amherst outfall	112.0-106.5	5.5	B	B
8	Connecticut River	Amherst outfall to above Oxbow	106.5-94.0	12.5	C	B
9	Connecticut River	Above Oxbow to below Oxbow	94.0-93.1	0.9	C	B
10	Connecticut River	Below Oxbow to South Hadley backwater	93.1-88.3	4.8	C	B
11	Connecticut River	South Hadley backwater to South Hadley Dam	88.3-86.6	1.7	C	B
12	Connecticut River	South Hadley Dam to Holyoke STP	86.6-83.7	2.9	U	C
13	Connecticut River	Holyoke STP to Chicopee River	83.7-80.7	3.0	U	C
14	Connecticut River	Chicopee River to Springfield STP	80.7-75.6	5.1	U	C
15	Connecticut River	Springfield STP to Westfield River	75.6-75.2	0.4	U	C

TABLE 7 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
16	Connecticut River	Westfield River to Leonard Street	75.2-73.1	2.1	U	C
17	Connecticut River	Leonard Street to Riverside Park	73.1-71.5	1.6	U	C
18	Connecticut River	Riverside Park to Mass.-Conn. State Line	71.5-70.7	0.8	U	C
19	Bachelor Brook	Connecticut River to Lampson Brook	0.0-10.2	10.2	B	B
20	Lampson Brook	Bachelor Brook to George Hannum St.	0.0-2.3	2.3	B	B
21	Stony Brook	Connecticut River to Route 116	0.0-1.8	1.8	B	B

Total Miles of Class B - 32.2
Total Miles of Class C - 33.7
Total Miles of Unsatisfactory Conditions - 15.9

LAKES AND PONDS

There have not been any intensive or baseline lake surveys conducted by the Division in the Connecticut Basin to date. During the summer of 1978 a number of baseline lake surveys will be carried out in the Connecticut Basin.

Inventory

Connecticut River Basin:

Number of Lakes and Ponds	97
Surface area of Lakes and Ponds (acres)	2,618
Number of Lakes and Ponds greater than 10 acres	47
Surface area of Lakes and Ponds greater than 10 acres	2,401
Number of officially recognized Great Ponds	3
Surface area of officially recognized Great Ponds (acres)	232

VIII - DEERFIELD RIVER BASIN

The Deerfield River originates in Stratton, Vermont and flows southerly into Northwestern Massachusetts. The river then flows generally eastward through Monroe, Rowe, Florida, Charlemont, Buckland, Shelburne, Conway, Deerfield, and Greenfield. At its confluence with the Connecticut River the Deerfield River is the boundary between the towns of Deerfield and Greenfield.

Major tributaries to the Deerfield in Massachusetts include: the South River which enters the Deerfield in Conway, the North River which enters the Deerfield in Shelburne, and the Green River which enters the Deerfield in Greenfield.

The Deerfield River drains a total area of 666 square miles. The drainage area in Massachusetts totals 442 square miles. The population of the drainage area in Massachusetts was estimated to be 32,370 in 1970. The yearly average flow at the United States Geological Survey (USGS) gage in West Deerfield is currently 1,280 cubic feet per second (cfs). The New England Power Company operates seven dams on the Massachusetts portion of the river to generate power. A major dam at Fife Brook became operable in 1975 as part of the Bear Swamp Pumped Storage Project. A new USGS gage was added to the Deerfield River at a point in Rowe just below the Fife Brook Dam. This gage became operable in 1974. The USGS maintains a total of six flow gaging stations on the Deerfield River and its tributaries in Massachusetts.

Sources of industrial pollution include treated paper waste discharged to the Deerfield in Monroe and treated textile waste discharged to the North River in Colrain. Municipal treatment facilities providing secondary treatment discharge to the Deerfield River in Monroe, Buckland, and Deerfield. The Greenfield Wastewater Treatment Plant discharges to the Green River about 0.5 miles above its confluence with the Deerfield. Untreated domestic wastes enter the Deerfield and its tributaries in Charlemont and Ashfield.

The waters of the Deerfield Basin generally meet or exceed Class B criteria throughout the basin. Exceptions are coliform violations in the Deerfield below Charlemont, and the South River below Ashfield. More serious problems occur in the Green River below the Greenfield discharge because the flow in this small stream is unable to assimilate this discharge. Plans are currently being prepared for treatment facilities to eliminate the problems in Charlemont and Ashfield. Further study will be necessary before a viable solution to the problems in the Green River can be proposed.

Water Quality Surveys

Three major water quality surveys have been completed in the Deerfield River Basin in recent years. These were carried out in 1965, 1973, and 1977.

The 1965 survey was conducted by the Massachusetts Department of Public Health. The river was sampled during a one week period in July and again in August. Samples were taken at a total of 12 stations. A complete

description of this survey and the results of the analysis of the samples taken has been published by this Division.

The 1973 water quality survey in the Deerfield Basin was conducted by the Massachusetts Division of Water Pollution Control. Again, this survey consisted of a week of sampling in July followed by another week of sampling in August. However, this survey was much more extensive than the 1965 survey. Several additional sampling stations were added in the Deerfield Basin and the samples were analyzed for phosphorus, ammonia-nitrogen, and nitrate-nitrogen. Photosynthesis data and extensive flow data were collected in 1973.

The Deerfield River Basin was intensively surveyed during the week of July 18, 1977 by the Massachusetts Division of Water Pollution Control. Composite samples were collected from Pelham Brook (Rowe), the Cold River (Charlemont) and Mill Brook (Charlemont) near their respective confluences with the Deerfield River. Composite samples were taken from Wheeler Brook (Greenfield) and an unnamed stream which runs under the City of Greenfield near their confluences with the Green River. Chemical samples were collected six times daily on Tuesday and Thursday. Bacteriological samples were taken on Tuesday and again on Thursday. Dissolved oxygen samples were taken six times daily on Tuesday, Wednesday and Thursday. Grab samples for metals and oil and grease analyses were taken at selected stations on Tuesday. Grab samples for microscopic and chlorophyll-a examination were taken on Tuesday and Thursday. Grab samples were taken at twenty-eight additional stations on September 12, 1977. These included dissolved oxygen, chemical and bacteriological samples at all stations and metals and oil and grease samples at selected stations. These grab samples were taken in an attempt to locate possible sources of non-point pollution in the Deerfield Basin.

The data collected during the 1965 and 1973 surveys is discussed in detail in the Deerfield River Study 1973 Part C. A similar report for the 1977 Deerfield Survey was published in the spring of 1978.

All major wastewater discharges in the Deerfield Basin have been sampled annually since 1975. The most recent data can be found in a report titled The Deerfield River Part B, 1977 Wastewater Discharge Data.

Additional water quality surveys will not be scheduled in the Deerfield Basin for at least five years.

Basin Segmentation

In order to define the present problems, the major streams of the Deerfield Basin have been broken down into a number of segments. These segments are listed in Table 8.

Along the main stem Deerfield River, the segment divisions occur at dams, at the confluence with major tributaries, at points where municipal discharges enter the river, and at points where major changes in flow regimes, other than those caused by dams, occur. The North River segment division occurs at the

Kendall Company WWTP. The South River segment division occurs near the point where a proposed treatment facility for the Town of Ashfield is expected to discharge. The Green River has one segment division where it begins to be affected by the Town of Greenfield and a second division at the Greenfield STP. Table 8 also lists the present condition and future use classification for each segment. The future use classification is based on the present water quality standards, while the present condition is based on the results of the 1977 water quality survey.

Present Conditions

Segment 1 - Vermont Line to Sherman Dam - This segment is subject to some coliform contamination from discharges occurring upstream in Vermont, but still meets Class B criteria.

Segment 2 - Sherman Dam to Fife Brook Dam - This segment is affected by the cooling water discharge from the Yankee Atomic Plant at Rowe. Repeated surveys have determined that this discharge does not adversely affect the water quality of the Deerfield River. The Monroe Bridge STP also discharges into this segment. The water quality of this segment meets Class B criteria.

Segment 3 - Fife Brook Dam to Cold River - The water quality of this segment meets Class B criteria.

Segment 4 - Cold River to USGS Gage, Charlemont - Untreated domestic discharges in Charlemont cause consistent coliform violations in this segment. The segment is currently only meeting Class C criteria.

Segment 5 - USGS Gage, Charlemont to Dam 4, Charlemont - Coliform violations from the previous segment are carried over into this segment. Again, only Class C criteria are met in this segment.

Segment 6 - Dam 4, Charlemont to North River - This segment meets Class B criteria.

Segment 7 - North River to Dam 3 - This segment meets Class B criteria.

Segment 8 - Dam 3 to Gardner Falls Dam - Effluent from the Buckland/Shelburne Sewage Treatment Plant is discharged into this segment. This segment meets Class B criteria.

Segment 9 - Gardner Falls Dam to Dam 2 - This segment meets Class B criteria.

Segment 10 - Dam 2 to Stillwater Bridge - This segment meets Class B criteria.

Segment 11 - Stillwater Bridge to Old Deerfield STP - This segment meets Class B criteria.

Segment 12 - Old Deerfield STP to Green River - This segment meets Class B criteria.

Segment 13 - Green River to confluence with the Connecticut River - This segment has a minor coliform problem and occasionally floating solids or oil can be seen. This segment, however, still meets Class B criteria.

Segment 14 - East Branch North River at Vermont Line to Kendall Company Discharge - This segment meets Class B criteria.

Segment 15 - Kendall Company discharge to confluence with the Deerfield River - This segment fully meets Class B criteria.

Segment 16 - Outlet Ashfield Pond to Emmets Road, Ashfield - This segment receives the untreated discharge from a sewer system which serves Ashfield Center. This causes severe coliform violations and significant nutrient violations. The segment currently only meets Class C criteria.

Segment 17 - Emmets Road, Ashfield to confluence with the Deerfield River- This segment meets Class B criteria.

Segment 18 - Vermont Line to Silver Street Bridge - This segment meets Class B criteria.

Segment 19 - Silver Street Bridge to Greenfield STP - Although some combined sewer discharges and urban runoff enter this segment, it still meets Class B criteria.

Segment 20 - Greenfield STP to confluence with Deerfield River - This segment is severely degraded by the discharge from the Greenfield STP. Severe nutrient and solids problems are present. Although the new secondary treatment plant has significantly upgraded the Greenfield discharge, this segment is still considered to be less than Class C water and accordingly the present condition is unsatisfactory.

TABLE 8

DEERFIELD RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Deerfield River	Vermont Line to Sherman Dam	42.4-41.7	0.7	B	B
2	Deerfield River	Sherman Dam to Fife Brook Dam	41.7-37.8	3.9	B	B
3	Deerfield River	Fife Brook Dam to Cold River	37.8-29.6	8.2	B	B
4	Deerfield River	Cold River to USGS Gage, Charlemont	29.6-25.4	4.2	C	B
5	Deerfield River	USGS Gage Charlemont, to Dam 4, Charlemont	25.4-19.7	5.7	C	B
6	Deerfield River	Dam 4, Charlemont to North River	19.7-18.8	0.9	B	B
7	Deerfield River	North River to Dam 3	18.8-16.9	1.9	B	B
8	Deerfield River	Dam 3 to Gardner Falls Dam	16.9-15.8	1.1	B	B
9	Deerfield River	Gardner Falls Dam to Dam 2	15.8-13.9	1.9	B	B
10	Deerfield River	Dam 2 to Stillwater Bridge	13.9-8.0	5.9	B	B
11	Deerfield River	Stillwater Bridge to Old Deerfield STP	8.0-4.4	3.6	B	B
12	Deerfield River	Old Deerfield STP to Green River	4.4-2.0	2.4	B	B
13	Deerfield River	Green River to confluence with the Connecticut River	2.0-0.0	2.0	B	B
14	North River	East Branch at Vermont Line to Kendall Company WWTP	9.5-2.5	7.0	B	B
15	North River	Kendall Company WWTP to confluence with Deerfield River	2.5-0.0	2.5	B	B
16	South River	Outlet of Ashfield Pond to Emmets Road, Ashfield	13.3-11.4	1.9	C	B

TABLE 8 (CONTINUED)

NUMBER		DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
17	South River	Emmets Road, Ashfield to confluence with Deerfield	11.4-0.0	11.4	B	B
18	Green River	Vermont Line to Silver Street Bridge	15.0-3.4	11.6	B	B
19	Green River	Silver Street Bridge to Greenfield STP	3.4-0.5	1.9	B	B
20	Green River	Greenfield STP to confluence with the Deerfield	0.5-0.0	0.5	U	B

Total Miles of Class B - 67.9
Total Miles of Class C - 11.8
Total Miles of Unsatisfactory Conditions - 0.5

LAKES AND PONDS

There have been no intensive lake surveys in the Deerfield Basin, but baseline surveys were carried out on four lakes during the summer of 1977. No report has been published to date.

Inventory

Deerfield River Basin

Number of lakes and ponds	23
Surface area of lakes and ponds (acres)	862
Number of lakes and ponds greater than 10 acres	16
Surface area of lakes and ponds greater than 10 acres	832
Number of officially recognized Great Ponds	2
Surface area of officially recognized Great Ponds (acres)	42

Classification

Name	Location	Severity Points	Stratified / Unstratified
Ashfield Pond	Ashfield	4	S
Sherman Reservoir	Monroe/Rowe/Whitingham, Vt.	4	S
Pelham Lake	Rowe	10	U
Plainfield Pond	Plainfield	3	U

IX - THE FARMINGTON RIVER BASIN

The Farmington River Basin covers a total area of 602 square miles. Approximately 149 square miles of this area are in southwestern Massachusetts.

The major portion of this area in Massachusetts drains into the West Branch of the Farmington River and its tributaries. The remaining portion drains into Pond and Valley Brooks, which form the East Branch of the Farmington River just below the state line in Connecticut. Throughout the entire basin, the terrain is hilly with large, relatively level areas occurring on the hilltops at about 1,200 feet above mean sea level. There are also numerous small mountain streams.

The headwaters of the West Branch of the Farmington are comprised of many small brooks and ponds in Becket, Massachusetts. From its formal beginning at the outlet of Hayden Pond in North Otis, the West Branch of the Farmington flows slowly through a swamp for about one mile. After leaving this swamp, the river flows through Otis Center. Upon leaving Otis Center the river enters a long northwest-southeast trending valley. At this point the flow of the river becomes more rapid and is joined by the Fall River three miles downstream.

From this point the West Branch of the Farmington River continues its rapid southeasterly flow, forming the town line between the towns of Sandisfield and Tolland as well as the boundary between Berkshire and Hampden counties, until it reaches the New Boston section of Sandisfield. During this stretch of approximately four miles, State Route 8 follows the west bank of the river very closely. This section flows through relatively uninhabited forest and has an average fall of 83 feet-per-mile.

The West Branch of the Farmington is joined by the Clam River one mile downstream of New Boston. At this point the river widens and the flow becomes less rapid as it reaches the backwater of the Colebrook Reservoir, 1.6 miles above the Massachusetts-Connecticut state line. This reservoir is to be used as a water supply for Hartford, Connecticut, in the year 2000.

From North Otis to the Massachusetts-Connecticut state line, the West Branch of the Farmington River is very rapid with an average fall of 41 feet per mile. The United States Geological Survey maintains one gage on the West Branch of the Farmington River in Massachusetts. It is located in the Roosterville section of Sandisfield and has a drainage area of 92.0 square miles with an average discharge for the period May 1913 to September 1972 of 178 cubic feet per second.

FALL RIVER

A large part of the headwaters of the Fall River are formed by Big Pond and Otis Reservoir. Flow in the river is regulated by Otis Reservoir, which is used for water storage and recreation. Because of Otis Reservoir and Big Pond, this portion of the basin contains a large seasonal population.

The USGS operates a gage on the Fall River in Otis. This gage has a drainage area of 16.5 square miles with an average discharge of 49 cubic feet per second.

CLAM RIVER

The headwaters of the Clam River are formed by many small streams located in uninhabited mountain wilderness. The Clam River is joined by the Buck River about two miles above its confluence with the West Branch of the Farmington River. The river is very rapid and has an average fall of about 100 feet per mile.

Water Quality Surveys

In the summer of 1974, the Division of Water Pollution Control conducted an intensive water quality survey of the Farmington River Basin. Samples from five stations on the Farmington River and three stations on tributary streams were collected six times daily during the weeks of June 10-14, 1974 and August 5-9, 1974. Dissolved oxygen tests were run on three consecutive days during each week. Chemical composites and bacterial samples were collected on Tuesday and Thursday of the weeks mentioned above. A time-of-travel study was also conducted during the week of August 5-9, 1974.

Only the Massachusetts portion of the Farmington River was covered in this survey. All work was done in conjunction with the Housatonic River Water Quality survey.

All tests pertaining to dissolved oxygen were analyzed at the Section's mobile laboratory set-up at the Lee Sewage Treatment Plant. Composite and bacterial samples from both surveys were transported to the Lawrence Experiment Station of the Massachusetts Department of Public Health where they were analyzed according to the procedures of the A.P.H.A.'s Standard Methods for the Examination of Water and Wastewater (13th Edition 1971, New York). A microscopic analysis was performed on August 5-9, 1974 and a macro-invertebrate study on July 9, 1974. All results were verified and placed in tabular and graphical form by the personnel of the Water Quality Section. The results are presented in the report, Farmington River, 1974 Part A Water Quality Survey Data which was published by the Division.

There are no known discharges to the Farmington River in Massachusetts; therefore, no wastewater discharge survey has been undertaken.

Segmentation

The Farmington River and its tributaries are divided into five segments on the basis of water use classifications. These segments are listed in Table 9 along with their present water use classifications and the existing water quality conditions.

Present Conditions

Segment 1 - Outlet, Shaw Pond to 1,000 feet upstream from the Mass.-Conn. state line - The first station sampled in 1974 (FA01) was at the outlet of a swamp below Hayden Pond. Experience with water quality in swamps has shown that the slight violation which may occur in the dissolved oxygen criteria, in this case for a cold-water fishery criterion, is the result of natural phenomena. The BOD_5 recorded at this station was slightly higher in August than during June (2.4 mg/l vs. 1.4 mg/l). This can be attributed to a lower flow. All other parameters were meeting established criteria for Class B waters.

Segment 2 - 1,000 feet upstream from Mass.-Conn. state line to state line - Station FA02 was located in Otis Center where the river had become wider and momentarily slower-moving. Higher total coliform counts were recorded during the 1974 survey (1,100 col/100 ml. and 1,300 col/100 ml.). It is felt that many of these coliform were from the runoff caused by the thunderstorms that preceded these two sampling dates. Other coliform samples as well as all other parameters tested easily met Class B criteria.

Stations FA04, FA05, and FA06 were all characterized by a rapid and shallow flow. Because of this, the D.O. stayed well above the 75% saturation value required by the Class B criteria. High total coliform values were also due to runoff caused by the storms. All other parameters tested were in accordance with Class B criteria.

Segment 4 - All streams of Farmington River Basin up to 1,000 feet upstream of Mass.-Conn. state line - Station FA04A, located on Fall River, showed clean water values meeting all Class B criteria.

Segment 5 - All other waters of the Farmington River Basin - This segment includes Benton Brook and the Clam River. These stations also showed values reflecting good water quality.

TABLE 9

FARMINGTON RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Farmington River	Outlet, Shaw Pond to 1,000 feet upstream from the Mass.-Conn. state line	17.4-0.2*	17.2	B	B
2	Farmington River	1,000 feet upstream from the Mass.-Conn. state line to the state line	0.2*-0.0	0.2	A	A
3	Fall River	Big Pond, Otis Reservoir Fall River	1.0**-0.0	1.0	B	B
4	All streams of the Farmington River Basin up to 1,000 feet upstream of the Mass.-Conn. state line		---	---	A	A
5	All other waters of the Farmington River Basin		---	---	B	B

Total Miles of Class A - 0.2
Total Miles of Class B - 18.2

* Mileage from state line.
** Mileage from Farmington River.

LAKES AND PONDS

There are 47 lakes and ponds in the Farmington River Basin, of which only one has been surveyed by the Division of Water Pollution Control to date. In June 1974 the Division conducted a water quality study on Shaw Pond located in the towns of Becket and Otis. Results of this study are available at the Division's office in Westborough.

Inventory

Number of lakes and ponds	47
Surface area of lakes and ponds (acres)	3,531
Number of lakes and ponds greater than 10 acres	33
Surface area of lakes and ponds greater than 10 acres	3,450
Number of officially recognized great ponds	2
Surface area of officially recognized great ponds	395

Classification

Name	Location	Severity Points	Stratified / Unstratified
Shaw Pond	Becket/Otis	5	S

X - THE FRENCH AND QUINEBAUG RIVER BASINS

The Quinebaug River Basin covers 744 square miles in south-central Massachusetts, eastern Connecticut, and northwestern Rhode Island. The Quinebaug River flows 76 miles from its source in Mashpaug Pond in Union, Connecticut, to its confluence with the Shetucket River in Norwich, Connecticut, forming the Thames River. Of the Quinebaug's 76 miles, 28 lie in Massachusetts and drain an area of 148 square miles. Major tributaries are Cady Brook in Massachusetts and the French, Five Mile, Moosup, and Pochaug rivers in Connecticut. Of these, the French is the largest, extending 26 miles from its source in Greenville Pond, Leicester, to the confluence with the Quinebaug River in Thompson, Connecticut. The French River drains an area of 93 square miles in Massachusetts. The population of the combined drainage areas of the French and Quinebaug rivers in Massachusetts was about 72,000 in 1970.

The French River flows generally south throughout its length from Leicester (beginning with Town Meadow Brook from Leicester to Greenville Pond) through Oxford, Dudley, and Webster to Thompson, Connecticut. Probably the best known feature along the French River is Lake Chargoggagoggmanchauggagoggchaubunagungamaugg (also known as Webster Lake) which drains into the river in Webster via Mill Brook. Other tributaries discharging to the French River are generally small and include Burncoat, Bartons, and Grindstone brooks in Leicester; the Little River in Oxford; Potash Brook in Webster; and Backwater and Sunset Hill brooks in Thompson. The Leicester, Oxford-Rochdale, Dudley, and Webster sewage treatment plants discharge their effluents to the French River. Seven major industries also discharge to the French River.

From its source in Mashpaug Pond, the Quinebaug River flows a short distance northwest to Hamilton Reservoir, which lies on the Connecticut-Massachusetts state line. Leaving this reservoir in Holland, Massachusetts, the river flows north to Sturbridge, where it passes through Old Sturbridge Village. Upon leaving Sturbridge, the river turns southeast to Southbridge, where it is joined by Cady Brook, and on through Dudley to recross the state line. After the French River enters in Thompson, Connecticut, the Quinebaug flows generally south through Putnam, Danielson, and Plainfield to its confluence with the Shetucket River in Norwich. This confluence forms the Thames River which continues south to Long Island Sound. The Sturbridge and Southbridge sewage treatmant plants along with two industries discharge their effluents to the Quinebaug River in Massachusetts. Additional wastes are discharged to Cady Brook in Charlton City by the town's sewage treatment plant, one industry, and several small domestic wastewater overflows.

Four major flood control dams were constructed in Massachusetts by the U.S. Army Corps of Engineers following extensive flooding in 1955. These are the Hodges Village Dam on the French River; the Buffumville Dam on the Little River, a tributary to the French River; and the East Brimfield and Westville dams on the Quinebaug River. The United States Geological Survey maintains eight flow gaging stations in the portion of the French and Quinebaug basins which were surveyed. The gaging station located on the French River in Webster drains an area of 85.3 square miles and had an average flow of 156 cubic feet per second from December 1948 to September 1974. The gaging station located just over the state line in Quinebaug, Connecticut, drains an area of 156 square miles and had an average flow of 267 cubic feet per second for the period from September 1931 to September 1974.

Water Quality Surveys

The French and Quinebaug rivers were intensively sampled most recently in 1976 in conjunction with the United States Environmental Protection Agency N.E. Regional office. These rivers were sampled at a total of 64 locations. 32 of these stations were on the French River and its tributaries, with the remaining 32 on the Quinebaug River and its tributaries. These data were published in March 1977 as a report entitled The French & Quinebaug Rivers Part A Water Quality Data.

Major waste discharges in the French and Quinebaug Basin were also sampled in 1976 as part of the Compliance Monitoring Program. The results have been summarized in The French & Quinebaug Rivers Part B Wastewater Discharge Data 1976.

Segmentation

Table 10 shows the division of the French and Quinebaug rivers into 14 segments--seven on the French and seven on the Quinebaug River and Cady Brook. Segment divisions are located at points of stream classification changes, at the point of introduction of each significant discharge, or number of closely grouped discharges, and at other points where significant changes in water quality occur.

Degrees of the particular water quality problems are determined by comparing present conditions to the streams assigned use classification, as in Table 10.

Present Conditions

Segment 1 - Quinebaug River above Sturbridge Sewage Treatment Plant - Samples collected in this segment in 1976 show no existing water quality problems. This segment is classified Anti-Degradation, since it is upstream of all existing discharges.

Segment 2 - Sturbridge Sewage Treatment Plant to Cady Brook - Slightly high nutrients were observed just below the treatment plant. Coliform bacteria were slightly high at the end of the segment, probably due to urban runoff. This segment is classified as Effluent Limited since, at this time, standards are being met. Increased flows at Sturbridge could result in a change to Water Quality.

Segment 3 - Cady Brook to Southbridge Sewage Treatment Plant - Class C standards are essentially met. Occasional discoloration occurs, due to treated effluent from American Optical Company. Biological study indicated only pollution-tolerant organisms. This is attributed to urban runoff in Southbridge. This segment is classified Effluent Limited since standards are met when the American Optical treatment facility is functioning properly.

Segment 4 - Southbridge Sewage Treatment Plant to West Dudley - High coliform bacteria, nutrients, and solids were observed below the treatment plant outfall.

Dissolved oxygen was somewhat low. Nutrient problems continue into the next segment. This segment is classified Water Quality, since advanced waste treatment at Southbridge will be required to solve the nutrient problems.

Segment 5 - West Dudley to state line - Nutrient problems continue from the previous segment.

Segment 6 - Cady Brook above Charlton City - No problems were observed in this segment. Since it is upstream of all waste discharges, it is subject to the anti-degradation provision.

Segment 7 - Charlton City to Quinebaug River - Severe coliform, D.O., solids, and nutrient problems are caused by the discharges from Charlton Woolen and the Charlton City Sewage Treatment Plant. Advanced waste treatment will be necessary to solve these problems; the segment is therefore classified Water Quality. Cady Brook recovers from these discharges and has no adverse effects on the Quinebaug River.

Segment 8 - French River (Town Meadow Brook) above Leicester Center Sewage Treatment Plant - No evidence exists of any problems here. This segment is subject to the anti-degradation provision.

Segment 9 - Leicester Sewage Treatment Plant to Massachusetts Turnpike - Slight D.O., coliform, solids, and nutrient problems in this segment are attributed to the treatment plant discharge. The segment is classified Water Quality since advanced waste treatment will be necessary. Chlorides problems may be caused by a road salt storage area.

Segment 10 - Massachusetts Turnpike to Mill Brook - Moderate coliform, solids, and slight nutrient problems at the upper end of this segment were caused by the Oxford/Rochdale treatment facility. Provision of best practicable treatment at this facility should solve the problems in the segment; the segment is, therefore, classified Effluent Limited.

Segment 11 - Mill Brook to Webster and Dudley Sewage Treatment Plants - Slightly high nutrients and high coliform counts have been noted since the Cranston Print Works and Anglo Fabrics discharges were connected to the Webster sewer system.

Segment 12 - Webster and Dudley Sewage Treatment Plants to state line - Moderate solids, D.O., high coliform, nutrients, and oil problems result from the two treatment plants. This segment, as well as the next two, are classified Water Quality, since advanced waste treatment will be necessary to solve the existing problems.

Segment 13 - State line to Sunset Hill Brook - Problems from the previous segment continue into this segment to a lesser extent. There are no known discharges to this segment in Connecticut.

Segment 14 - Sunset Hill Brook to Quinebaug River - Coliform and solids improve somewhat; other problems from the upstream segments continue. The Thompson, Connecticut Sewage Treatment Plant discharges into this segment. There are no discernible effects caused by the discharge from this small treatment facility.

TABLE 10

FRENCH AND QUINEBAUG RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Quinebaug River	Hamilton Reservoir to Sturbridge STP	Above 19.7	11.0	B	B
2	Quinebaug River	Sturbridge STP to Cady Brook	19.7-13.4	6.3	B	B
3	Quinebaug River	Cady Brook to Southbridge STP	13.4-12.2	1.2	C	C
4	Quinebaug River	Southbridge STP to West Dudley	12.2-10.1	2.1	C	C
5	Quinebaug River	West Dudley to state line	10.1-8.0	2.1	U	C
6	Cady Brook	Outlet of Glen Echo Lake to Charlton City	6.1-5.1	1.0	C	B
7	Cady Brook	Charlton City to Quinebaug River	5.1-0.0	5.1	U	C
8	French River	Sargent Pond to Leicester STP	27.7-27.0	0.7	B	B
9	French River	Leicester STP to Mass. Pike	27.0-22.2	4.8	C	B
10	French River	Mass. Pike to Mill Brook	22.2-10.8	11.4	C	B
11	French River	Mill Brook to Webster-Dudley STP	10.8-8.0	2.8	U	C
12	French River	Webster-Dudley STP to state line	8.0-7.1	0.9	U	C
13	French River	State line to Sunset Hill Brook	7.1-2.2	4.9	C	C
14	French River	Sunset Hill Brook to Quinebaug River	2.2-0.0	2.2	B	B

Total Miles Class A - 0.0
Total Miles Class B - 20.2
Total Miles Class C - 25.4
Total Miles Unsatisfactory Condition - 10.9

LAKES AND PONDS

Inventory

Number of Lakes and Ponds	121
Surface area of Lakes and Ponds (acres)	5,989
Number of Lakes and Ponds greater than 10 acres	69
Surface area of Lakes and Ponds greater than 10 acres	5,713
Number of officially recognized Great Ponds	8
Surface area of officially recognized Great Ponds	781

Classification

Name	Location	Drainage	Stratified / Unstratified	Severity Points
Glen Echo Lake	Charlton	French	S	10
Greenville Pond	Leicester	French	S	10
Buffumville Reservoir	Charlton/Oxford	French	S	8
Lake George	Wales	Quinebaug	S	8
Gore Pond	Charlton/Dudley	French	S	7
Holland Pond	Holland	Quinebaug	S	5
Stiles Reservoir	Leicester/Spencer	French	S	5
Slaters Pond	Oxford	French	S	4
Little Alum Pond	Brimfield	Quinebaug	S	3
Leadmine Pond	Sturbridge	Quinebaug	S	2
Big Alum Pond	Sturbridge	Quinebaug	S	1
Hayden Pond	Dudley	French	S	1
Texas Pond	Oxford	French	U	9
East Brimfield Reservoir	Brimfield/Sturbridge	Quinebaug	U	7
Sherman Pond	Brimfield	Quinebaug	U	7
Walker Pond	Sturbridge	Quinebaug	U	5
Granite Reservoir	Charlton	French	U	4
Pierpoint Meadow Pond	Charlton/Dudley	French	U	4
Robinson Pond	Oxford	French	U	4
Merino Pond	Dudley	French	U	2

Baseline Studies

As of this date no intensive survey has been conducted on any of the lakes or ponds in this basin. Twenty baseline studies have been made, however. These include:

Name	Location	Date
Big Alum Pond	Sturbridge	1976
Buffumville Reservoir	Charlton	1976
East Brimfield Reservoir	Brimfield/Sturbridge	1976
Glen Echo Lake	Charlton	1974
Gore Pond	Dudley/Charlton	1976
Granite Reservoir	Charlton	1974
Greenville Pond	Leicester	1974
Hayden Pond	Oxford	1976
Holland Pond	Holland	1976
Lake George	Wales	1976
Leadmine Pond	Sturbridge	1976
Little Alum Pond	Brimfield	1976
Merino Pond	Dudley	1976
Pierpoint Meadow Pond	Dudley/Charlton	1976
Robinson Pond	Oxford	1976
Sherman Pond	Brimfield	1976
Slaters Pond	Oxford	1976
Stiles Reservoir	Spencer/Leicester	1976
Texas Pond	Oxford	1974
Walker Pond	Sturbridge	1976

The results of this study are found in a report entitled Baseline Water Quality Studies of Selected Lakes and Ponds French and Quinebaug River Basins 1976.

XI - THE HOOSIC RIVER BASIN

The Hoosic River rises in the northwestern corner of Massachusetts and travels through Vermont and parts of New York, where it joins the Hudson River just above Albany. The total watershed area is 713 square miles of which 165 square miles are in Massachusetts. In Massachusetts the river is made up of the mainstem, South Branch, North Branch, Green River and many smaller tributaries.

The North Branch begins in Reedsborough, Vermont and flows southerly through Standord, Vermont into Clarksburg, Massachusetts. The river continues in a southwesterly direction until joining the South Branch in North Adams. The headwaters of the South Branch rise as far south as Pittsfield. The South Branch itself, however, begins at the outlet of Cheshire Reservoir, Cheshire and flows north through Adams to the confluence with the North Branch in North Adams. From the confluence the mainstem travels in a northwesterly direction through Williamstown to Pownal, Vermont.

The watershed within Massachusetts includes all of the towns of Williamstown, Clarksburg, and Cheshire; practically all of the City of North Adams, the towns of Adams and New Ashford; and small portions of Hancock, Lanesborough, Pittsfield, Dalton, Savoy, Florida, and Windsor. The Hoosic River Valley in Massachusetts has a number of concentrated areas of population, the major areas being the City of North Adams and the towns of Adams and Williamstown.

Due to the past history of high flood damage along the Hoosic River, three gages were built along the banks to monitor flow--one in Williamstown on the mainstem, one in North Adams on the North Branch, and the other in Adams on the South Branch. In addition, gages were built in Williamstown along the Green River, and in Cheshire along Dry Brook.

Portions of the Hoosic River are used as a source of water supply for industrial purposes, while unpolluted tributaries of the river act as water supplies for Adams, Cheshire, North Adams, and Williamstown.

The three major sources of municipal wastes come from treatment plants in Adams, North Adams, and the Hoosic Water Quality District Wastewater Treatment Plant in Williamstown. The major industrial discharges come from Widen Tannery in North Adams and several industries via the Adams Treatment Plant in Adams. Plans are currently underway to connect the North Adams Wastewater Treatment Plant and Widen Tannery to the Hoosac Water Quality District Treatment Plant in Williamstown.

Water Quality Surveys

The most recent intensive survey was conducted during the summer of 1977. A total of 25 stations were sampled on the Hoosic and its tributaries. The results of this survey were published in a report entitled The Hoosic River Part A -Water Quality Data 1977.

Major wastewater discharges to the Hoosic and its tributaries were also sampled in 1977 as part of the Compliance Monitoring Program. The results of this study are compiled in The Hoosic River Part B 1977 - Wastewater Discharge Data.

Segmentation

In Table 11 the Hoosic River is divided into nine segments. The north and south branches are divided into two segments each, while the remainder of the river is divided into four segments. The Green River is also segmented. The length of these segments was governed by stream classification changes, waste discharges, and tributary locations.

The severity of a particular water quality problem is determined by comparing present conditions to the stream's assigned use classification. This is done in Table 11. The present condition is summarized as follows:

Present Conditions

Segment 1 - Massachusetts-Vermont State line to the Clarksburg-North Adams Town line - The major problems of this section stem from illegal entry of raw sewage to the North Branch. At the present time, there is no centralized sewer system in the Town of Clarksburg. Since many of the portions of town are not suited for subsurface disposal, domestic sewage enters the North Branch either directly or through seepage. This pollution causes violations in coliform standards. There are no industries within this section that discharge wastewater to the river. This segment has a future use classification of B, but due to the high coliform counts, its present condition is C.

Segment 2 - Clarksburg-North Adams town line to the confluence with the South Branch - With the elimination of the industrial discharges since 1969, there are no known point sources of pollution in this segment. However, the outfalls in Clarksburg, as mentioned in Segment 1, are still being reflected in this section's high coliform counts. These counts are not high enough to violate this segment's C classification, but they do prevent an upgrading to B.

Segment 3 - Outlet of Cheshire Reservoir to the Adams WTP - In this segment, the South Branch receives minor seepage from sub-surface disposal units in Cheshire, along with a batch discharge of treated industrial wastewater from the Berkmatic Company. The effects of this pollution on the river immediately below the outfalls cannot be accurately determined without a series of special studies. The South Branch had assimilated these wastes by the time it was monitored in southern Adams. The parameters sampled at that station reflected levels typical of clean water conditions. According to the best available data, this segment was meeting its future use classification of B in 1973.

Segment 4 - Adams WTP to the confluence with the North Branch - Within this segment, the South Branch receives the treated effluent from the Adams WWTP and the Charles Pfizer Lime Company, as well as the highly concentrated runoff from the Adams dump. Of these three sources, the Adams facility and the Adams dump represent water quality problems. The failure of the Adams WWTP to reach operational efficiency has created high organic, solids, color, and turbidity concentrations within the river. In addition to this, their inadequately dewatered sludge is being disposed of directly beside the river, causing runoff to the river and the possibility of washout during high flows. The Adams dump, according to the waste discharge data of 1973, was adding substantial amounts of organics, solids, nitrates, and metals to the river. There is one other source of pollution within this segment--the Holland Chemical Company. Their treatment facility, which should not have an outfall, often discharges during wet weather. The severity of all these additions is

further compounded by their location in reference to the headwaters. The low flow in the Hoosic at this point supplied only a limited dilution capacity, which created a critical water quality situation. The dissolved oxygen concentrations, however, did not refelct the oxygen loss from the presence of the pollution, due to the offsetting effect of high surface aeration. This segment, due mainly to the Adams WWTP and the Adams dump, did not meet its future use classification of C and is, therefore, considered to be unsatisfactory condition

Segment 5 - Confluence with the North Branch to the North Adams STP - The major source of pollution within this segment is the untreated outfalls from the Sprague Electric Company. The water quality in this section is also dependent on the condition of the outfalls discussed in segments 1 and 4. The combined effects of this pollution were reflected in the following water quality parameters: coliform, dissolved oxygen, solids, color, metals and nutrients. Specific additions from Sprague Electric include: nitrate-N, total phosphorus and aluminum. The problems within this segment are further complicated by the development of the river channel for flood control. The concrete channel creates a shallow depth and extreme velocities, along with providing an ideal media for algal growth. At the end of this channel, a velocity reducing pool acts like an impoundment which, in turn, stimulates algal production in the nutrient-rich river. The combined effects of the upstream discharges and the environment created by the flood control structure cause violations in the water quality criteria for this segment's future use classification of C. This segment is, therefore, presently considered to be unsatisfactory condition.

Segment 6 - North Adams STP to the re-entrance of the Widen Tannery Diversion- The North Adams Primary Sewage Treatment Plant has been eliminated from this segment. The sewage is now being piped to the Hoosic Water Quality District Wastewater Treatment Plant. Severe coliform and solids problems, along with high nutrient readings carried over from the previous segment, cause this reach to fail to reach its C classification.

Segment 7 - Re-entrance of Widen Tannery Diversion to the Williamstown STP - The Hoosic River continues to receive the wastes from Widen Tannery. Although this discharge is to be removed to the STP soon, this source still creates severe water quality problems in the river for the remaining distance in Massachusetts. The most dominating characteristics of the Widen Discharge are the vivid color changes which, in turn, control the color of the river, and the unpleasant odor, which remains with the river for many miles. Other additions from the Tannery include major chromium, solids and organic concentrations. The combined effect of these two discharges has created violations of the dissolved oxygen criteria. This segment is presently considered to be U, due to the failure of the Hoosic to meet the future use classification of C.

Segment 8 - Williamstown STP to Route 364 bridge in Pownal, Vermont - Within this segment the Hoosic receives the secondary outfall from Hoosic Water Quality District Wastewater Treatment Plant. This STP, along with the discharges in segments 6 and 7, dominate the water quality. Coliform counts continue to reflect the municipal facility in Williamstown and the effect of upstream counts. It is only as the Hoosic leaves Massachusetts that the river's water quality shows signs of recovery from the previous outfalls. This section is presently considered to be unsatisfactory condition.

TABLE 11

HOOSIC RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	North Branch, Hoosic River	From Mass.-Vt. state line to Clarksburg-North Adams town line	Above 10.0, 2.3	7.6	C	B
2	North Branch, Hoosic River	Clarksburg-North Adams town to confluence with South Branch, Hoosic River	10.0,2.3-10.0,0.0	2.3	C	C
3	South Branch, Hoosic River	From the outlet of Cheshire Reservoir to the Adams STP	23.5-15.4	8.1	B	B
4	South Branch, Hoosic River	From the Adams STP to the confluence with the North Branch, Hoosic River	15.4-10.3	5.1	U	C
5	Hoosic River	From the confluence with the North Branch to the North Adams STP	10.3-7.4	2.9	U	C
6	Hoosic River	From the North Adams STP to re-entrance of Widen Tannery diversion	7.4-6.7	0.7	U	C
7	Hoosic River	From the re-entrance of Widen Tannery Diversion to the Williamstown STP	6.7-3.7	3.0	U	C
8	Hoosic River	From the Williamstown STP to Route 364 bridge, Pownal, Vt.	3.7-0.0	3.7	U	C
1T	Green River	From the Springs Restaurant, New Ashford, to confluence	5.6,9.2-	9.2	B	B

Total Miles of Class B - 17.3
Total Miles of Class C - 9.9
Total Miles of Unsatisfactory Condition - 15.4

Segment 1T - Green River from the Springs Restaurant in New Ashford to the confluence with the Hoosic River - The Green River receives wastewater pollution from a number of sources, including the treated outfalls from the Springs Restaurant, the Mt. Greylock Regional High School and individual raw sewage discharges from adjacent homes. Upstream reaches have not been monitored. Results from samples taken near the confluence indicate the Green River's ability to assimilate the upstream wastes. The effects of the discharges on the river immediately below their point of entry cannot be determined without further investigation. According to the best data available, this segment was not meeting its future use classification of B in 1977.

LAKES AND PONDS

There are 17 lakes and ponds in the Hoosic River Basin. No intensive surveys have been conducted in this basin; however, one baseline study has been made. This was conducted on Cheshire Reservoir at the head of the South Branch. This work was done in the summer of 1977. A report of this investigation is presently being prepared.

Inventory

Hoosic River Basin

Number of Lakes and Ponds	17
Surface area of Lakes and Ponds (in acres)	616
Number of Lakes and Ponds greater than 10 acres	7
Surface area of Lakes and Ponds greater than 10 acres	586
Number of officially recognized Great Ponds	---
Surface area of officially recognized Great Ponds (in acres)	---

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Cheshire Reservoir	Cheshire/Lanesborough	7	U

XII - HOUSATONIC RIVER BASIN

The Housatonic River rises in western Massachusetts and travels south 131 miles through Massachusetts and Connecticut to Long Island Sound. The total watershed area is 1,950 square miles, of which approximately 500 square miles are in Massachusetts.

The Housatonic Basin in Massachusetts has a maximum east-west width of 19 miles and a maximum length in a north-south direction of 38 miles. The valley is bordered on the west by the Taconic Range and on the east by the Berkshire Hills. The valley is relatively steep and narrow at the headwaters of its branches, but broadens and flattens as it nears Connecticut.

The Housatonic River in Massachusetts consists of the main stem, East, West, and Southwest Branches, and many major tributaries, including the Williams and Green rivers.

Water Quality Surveys

In order to formulate an accurate picture of the water quality of the Housatonic River, a clear understanding of the existing water quality is necessary. Intensive sampling surveys have been completed at instream locations and at point sources to allow for an accurate analysis of the interaction between discharges and river.

The instream sampling program was completed by the Division in 1974 and the data have been published under the title The Housatonic River Study Part A, 1974 Data Record on Water Quality. More recent information was gathered in a special survey conducted during the summer of 1977. This information, which is presently unpublished, will in most cases, form the basis of the present water quality.

The information concerning waste discharges of the basin was also conducted in 1977. These data have been published by the Division in a report entitled The Housatonic River Study, Part B 1977 - Wastewater Discharge Data.

Segmentation

In order to more readily understand the effects of discharges on the river, the Housatonic Main Stem, the East Branch, and the major tributaries of the basin have been broken down into segments. The length of these segments is governed by stream classification changes, waste discharges, and tributary and impoundment locations.

Present Conditions

Segment 1 - The East Branch from its headwaters to Old Windsor Road - This section was receiving pollution in the form of raw domestic sewage from the Town of Hinsdale in 1974. An interceptor sewer has recently been installed, providing connection of the discharges to the City of Pittsfield's Wastewater Treatment Plant. This section has shown considerable improvement since 1974, and is presently meeting its use classification.

Segment 2 - The East Branch from Old Windsor Road to Crane Paper Company Wastewater Treatment Plant - There are no known sources of pollution in this segment. There was a slight oxygen demand within Center Pond both in 1974 and 1977. This is believed to be a direct result of the decomposition of vegetative matter brought naturally to the pond from upstream runoff. This segment meets its classification.

Segment 3 - The East Branch from Crane Paper Company Wastewater Treatment Plant to the confluence with Unkamet Brook - The effluent from the Crane Paper Company's Wastewater Treatment Plant is discharged at the upstream reach of this segment. The quality of this discharge is critical due to the limited assimilative capacity available. Although improvement of the treatment facility has taken place since the 1974 survey, results of the 1977 sampling indicate that the treatment provided is still inadequate, as it does not allow this section to meet the water quality criteria.

Leachate from the City of Pittsfield Sanitary Landfill drains into the downstream portion of this segment. Although the concentration of pollutants in the leachate were found to be extremely high, the flow during the summer months is reduced to practically zero. The landfill, therefore, showed no effect on the river during the 1977 survey.

Segment 4 - The East Branch from the confluence with Unkamet Brook to Newell St.- Two outfalls from the General Electric Company discharge into this segment. One of the outfalls is treated by an oil separator and the other by a chemical retention pond prior to discharge to Unkamet Brook. This brook runs a very short distance south before joining the East Branch.

Overall, the addition of these two discharges compound the problems in the East Branch. The most critical problem is the further reduction in the dissolved oxygen concentration. These lowered DO levels cause violations in the criteria, which prevent this segment from meeting its assigned use classification.

Segment 5 - The East Branch from Newell Street to the confluence with the West and Southwest Branches - The General Electric Company has three additional major discharges which enter the East Branch of the Housatonic River. These discharges are run through oil separators before entering the river at the upper reach of this segment. This wastewater, like that entering the previous segment, causes continued violations of the dissolved oxygen criteria.

Other parameters of concern in this segment are coliform bacteria, oil and grease, and polychlorinated biphenols. Presently, problems exist with each of these parameters. Further evaluation will be conducted during the 1978 survey. The combined effects of G.E. and Crane Paper Company prevent this segment from meeting the classification criteria.

Segment 6 - The Housatonic River from the confluence with the West and Southwest Branches to the Pittsfield Wastewater Treatment Plant - The West and Southwest Branches meet the East Branch at the beginning of this reach and form the mainstem Housatonic River. There are no known point sources of pollution entering this segment.

The two branches entering from the west are meeting their assigned use classification of B, although 1974 data indicated slight pollution problems. The wastes in the East Branch continue to dominate the water quality, but to

a lesser extent due to the dilution provided by the West and Southwest Branches.

Violations of dissolved oxygen and coliform criteria prevent this segment from meeting its classification.

Segment 7 - The Housatonic River from the Pittsfield Wastewater Treatment Plant to the North Lenox Wastewater Treatment Plant - The major source of pollution in this segment is the City of Pittsfield Wastewater Treatment Plant. This plant is currently being upgraded to an advanced waste treatment facility. At the time of the 1977 sampling, however, it was providing the equivalent of secondary treatment with the exception of chlorination. Although the plant has shown great improvement since the 1974 survey, the combined effect of this wastewater and the wastewater from upstream reaches which has not been assimilated, still affects the water quality.

Minor dissolved oxygen violations occurred during the 1977 survey. High coliform counts, reflecting the plant's failure to chlorinate, were also found. In addition to these two parameters, the introduction of large quantities of nutrients, although not causing any immediate problems in this section, do contribute to severe water quality conditions in later reaches.

The Housatonic River, due for the most part to the Pittsfield WWTP and to a somewhat lesser degree to the East Branch outfalls, is presently considered not meeting its classification.

Segment 8 - The Housatonic River from the North Lenox Wastewater Treatment Plant to the inlet of Woods Pond - The section of river in this segment is directly upstream of Woods Pond. The pond's influence on the river's velocity is already evident. The low rate of reaeration caused by the slow velocity is not enough to allow the river to recover from the upstream discharges.

There is a small inadequately treated discharge at the beginning of this segment, as well as a raw discharge from the Eastover Resort, which enters the river via Yokum Brook. Although organic increases were not evident in 1977, coliform bacteria concentrations increased significantly.

Legal action against Eastover is currently underway, while the North Lenox Plant will soon be eliminated and all flow to the plant will be pumped to the City of Pittsfield Wastewater Treatment Plant for treatment. This segment is presently not meeting its assigned criteria.

Segment 9 - The Housatonic River from the North Lenox Wastewater Treatment Plant to the Inlet of Woods Pond - This segment includes Woods Pond from its inlet to its outlet. Because of the location below the major discharges from Pittsfield and Dalton, the pond serves as a catch basin for the upstream wastewater. The abundance of instream nutrients entering the pond stimulates algal growth. During the summer months, algal populations grow to bloom proportions. This heavy growth causes dissolved oxygen to reach super saturation during the day and lows at night. In addition, benthal deposits continuously resuspend, causing floating debris, scum, oil and other matter which produce objectionable odor, color and turbidity. Due to many criteria violations, this segment is not meeting its classification.

Segment 10 - The Housatonic River from the Lenox Center Wastewater Treatment Plant and outlet of Woods Pond to the Lenoxdale Wastewater Treatment - The Housatonic receives the treated wastewater from the Lenox Wastewater

Treatment Plant at the beginning of this segment. The treatment provided at this plant is adequate, so there is no significant addition to the river's pollutional load. Due to a carry-over effect, however, violations of coliform bacteria criteria do exist.

Great improvements were seen in this segment over the 1974 conditions due to the reduction in pollutional loadings above Woods Pond. The use classification, however, is still not being met due to the coliform violations.

Segment 11 - The Housatonic River from Lenoxdale Wastewater Treatment Plant to the P.J. Schweitzer Paper Company Wastewater Treatment Plant - The Housatonic River receives the treated effluent from the Lenoxdale Wastewater Treatment Plant at the beginning of this segment. This plant's effluent is very much like that of the Lenox Center Plant in that it adds very little to the river's pollutional load. Toward the end of this segment the river nears the impoundment at P.J. Schweitzer Paper Company and its velocity slows once again. Algae carried down from Woods Pond become active and contribute to slight diurnal fluctuation in the dissolved oxygen concentrations. However, DO levels remained high and violations did not occur during the 1977 survey. Coliform bacteria carried over from the upstream discharges cause minor problems. Due to these coliform violations, the river is not meeting its classification in this segment.

Segment 12 - The Housatonic River from the P.J. Schweitzer Paper Company Wastewater Treatment Plant to the confluence with Goose Pond Stream - The P.J. Schweitzer Paper Company discharges its treated wastewater into the upstream reach of this segment. The company has provided the equivalent of secondary treatment by constructing two separate treatment facilities. The construction of these facilities has led to a major decrease in the waste additions to the river.

Dissolved oxygen values dip slightly, but not enough to cause concern. Once again, the problem lies with the carried-over coliform bacteria. As a result of the discharges above Woods Pond and the resulting coliform levels, this segment is considered not meeting its classification.

Segment 13 - The Housatonic River from the confluence of Goose Pond Stream to the Lee Wastewater Treatment Plant - Goose Pond Stream enters the Housatonic River at the beginning of this segment. Although this stream carries the treated discharge from the Westfield River Paper Company, these additions to the stream are not evident by the time it reaches the Housatonic River.

Although a sampling station was not located within this segment, moderate velocities indicate minimal algal activity and adequate reaeration. The river, for the first time since Dalton, is considered to be meeting its assigned classification.

Segment 14 - The Housatonic River from the Lee Wastewater Treatment Plant to the Laurel Mill, Hurlbut Paper Company - The Lee Wastewater Treatment Plant discharges into the upper portion of this segment. Although a sampling station could not be located directly below the discharge, results of compliance monitoring on the plant indicate no significant impact on the water quality of the river occurs. This segment is presently meeting Class B criteria.

Segment 15 - The Housatonic River from the Laurel Mill to the Willow Mill, Hurlbut Paper Company - The Laurel Mill of the Hurlbut Paper Company discharges its treated wastes into this segment. This discharge does not

have a serious impact on the Housatonic's water quality. However, a short distance downstream, the slowing down of the river as it approaches the dam at the Hurlbut's Willow Mill causes diurnal fluctation in the dissolved oxygen. These problems were not serious enough to cause violations in Class B criteria. Based on the best available data, this segment is of Class B quality.

Segment 16 - The Housatonic River from the Willow Mill, Hurlbut Paper Company to the confluence with Kampoosa Brook - This short section of river receives the treated discharge from the Willow Mill of the Hurlbut Paper Company. This discharge, like that from the Laurel Mill, does not have a serious impact on the river's water quality.

There was no sampling station within this segment due to its inaccessibility. It is believed that the conditions within this segment are similar to those in the previous segment. This suggests that the Housatonic is meeting its assigned classification.

Segment 17 - The Housatonic River from the confluence with Kampoosa Brook to the inlet of Rising Pond - This segment is receiving an unchlorinated discharge from the Stockbridge Wastewater Treatment Plant and seepage from individual disposal units in Stockbridge. Samples taken in 1977 indicated that dissolved oxygen criterion for a B classification is being met, but the coliform criterion is in slight violation.

Segment 18 - The Housatonic River from inlet to outlet, Rising Pond - This segment includes Rising Pond, the third major impoundment along the Housatonic River. The reduction of the river's velocity causes increased algal activity and significant settling of suspended matter. The massive accumulation of this settled matter eventually resuspends in the form of sludge cakes, causing objectionable odor and turbidity.

The daily fluctuation in DO, due to algal activity, do not violate DO criteria; however, due to poor aesthetics, this segment is less than B quality.

Segment 19 - The Housatonic River from the outlet of Rising Pond to the confluence with the Williams River - The Housatonic in 1974 was receiving untreated wastewater from the Rising Paper Company. This discharge has been connected to the Great Barrington Sewerage System and is now treated at the Great Barrington Wastewater Treatment Plant.

The 1977 sampling effort indicated that this segment is meeting its B classification.

Segment 20 - The Housatonic River from the confluence with the Williams River to the Great Barrington Wastewater Treatment Plant - This segment receives the relatively clean waters of the Williams River and, up until August 1974, numerous outfalls of raw sewage from the Village of Great Barrington. These individual outfalls have been connected to the Great Barrington Wastewater Treatment Plant. This segment easily meets Class B criteria.

Segment 21 - The Housatonic River from the Great Barrington Wastewater Treatment Plant to the confluence with the Green River - The Great Barrington Wastewater Treatment Plant discharges into the upper reaches of this segment. The "secondary" treated effluent has only minor effects on the river. Within this segment the Housatonic River enters that portion of the valley often referred to as "the meanders." The slope of the channel changes significantly--from 15 feet-per-mile on the average for the first 20 segments to approximately 2 feet-per-mile for this segment and the two segments immediately downstream.

The change in slope brings about a change in velocity. This, in turn, stimulates algal growth. Although algal activity increases, the minimum DO concentrations remain above those required for Class B. This segment is meeting its assigned classification of B.

Segment 22 - The Housatonic River from the confluence with the Green River to the confluence with Hubbard Brook - There are no known point sources of pollution in this segment. The 1977 sampling program, however, indicates increases in coliform bacteria counts. This is assumed to be the result of inadequately operating subsurface disposal units.

The river in this segment receives the relatively clean waters of the Green River and meanders south out of Great Barrington and into Sheffield. Slight fluctuation in dissolved oxygen levels occur as a result of meanders; however, these are not significant enough to cause violations of Class B DO criteria. Due to coliform violations, this segment is not meeting B water quality.

Segment 23 - The Housatonic River from the confluence with Hubbard Brook to the Massachusetts-Connecticut state line - The only pollution entering the Housatonic River in this segment is believed to be seepage from individual disposal systems in Sheffield's town center. This pollution does not have any significant impact on the Housatonic's water quality and the river is considered meeting B classification.

Segment 24 - The West Branch Housatonic River from its headwaters to the confluence with the East Branch - There are no known point sources of pollution within this segment. However, a sampling station located just below the confluence of the West and Southwest Branches indicated higher than background levels of certain parameters in 1974. At the present time, the possible sources of these increases are unknown. Further investigation will be conducted in 1978. According to the best available data, this stream is meeting its B classification.

Segment 25- The Southwest Branch Housatonic River from its headwaters to confluence with the West Branch - There are no point sources of pollution in this segment and its classification is assumed to be met.

Segment 26 - The Goose Pond from its confluence with the Housatonic River to the Westfield River Paper Company Discharge at the Electric Generating Station - Just prior to its confluence with the Housatonic River, Goose Pond Stream receives a discharge from the Westfield River Paper Company. The treated effluent from this mill was not reflected in the stream's water quality in 1974.

In 1976 the discharge was diverted to a penstock. This penstock diverts flow from a dam below Goose Pond to a power generating station on Route 20. The penstock flow is greater than that of the former discharge site reducing the impact of the wastes. This segment is meeting B classification.

Segment 27 - The Goose Pond Stream from the Westfield River Paper Company Discharge at the power generating station to its source - There are no known sources of pollution in this segment and the stream is considered meeting its B classification.

Segment 28 - The Williams River from its confluence with the Housatonic to its source - The Williams River was sampled in 1974 approximately one mile above its confluence with the Housatonic. The conditions at this station were comparable to any clean water station in the basin. There are, however, a number of known discharges of raw sewage in the upstream reaches near West Stockbridge.

The additions to the instream pollution load at West Stockbridge had been assimilated and were not apparent in the 1974 data. Violations in criteria may occur upstream.

According to the best available data, this stream is meeting its B classification--at least at the 1974 sampling site.

Segment 29 - The Green River from its confluence with the Housatonic to the Massachusetts-New York state line - The Green River was sampled a short distance above its confluence with the main stream Housatonic River. The data collected in 1974 indicate clean water conditions. The Green River is considered meeting its B classification.

Segment 30 - Hubbard Brook from its confluence with the Housatonic River to its source - Hubbard Brook was sampled during the 1974 surveys and was found to be not meeting its assigned B classification. The major violation was the coliform bacteria criteria. High coliform counts were attributed to the discharge of raw sewage from individual homes in and around the Town of Sheffield. The problems are believed to still exist and, therefore, the B classification is not being met.

LAKES AND PONDS

There are 113 lakes and ponds in the Housatonic River Basin. An intensive water quality survey has been conducted on Pontoosuc Lake. These data will be published by the Division as soon as the data becomes finalized. In addition, baseline water quality studies have been conducted on twelve other waterbodies. The findings of these studies are listed in a report entitled Baseline Water Quality Studies of Selected Lakes and Ponds 1976 Housatonic River Basin.

TABLE 12

HOUSATONIC RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	East Branch, Housatonic River	Headwaters to Old Windsor Rd., Dalton	Above 63.1	5.9	B	B
2	East Branch, Housatonic River	From Old Windsor Rd.,Dalton, to Crane Paper Co.,WTP outfall, Pittsfield	63.1-60.9	2.2	B	B
3	East Branch, Housatonic River	From Crane Paper WTP outfall to confluence with Unkamet Brook, Pittsfield	60.9-59.3	1.6	U	C
4	East Branch, Housatonic River	From confluence with Unkamet Brook to Newell St., Pittsfield	59.3-57.1	2.2	U	C
5	East Branch, Housatonic River	From Newell St. to the confluence with the West and Southwest Branches, Pittsfield	57.1-55.4	1.7	U	C
6	Housatonic River	From confluence with West and Southwest Branches to the Pittsfield STP	55.4-50.9	4.5	U	C
7	Housatonic River	From the Pittsfield STP to the North Lenox STP, Lenox	50.9-49.1	1.8	U	C
8	Housatonic River	From the North Lenox STP to the inlet of Woods Pond	49.1-46.3	2.8	U	C
9	Housatonic River	From the inlet of Woods Pond to the Lenox Center STP and outlet of Woods Pond	46.3-45.0	1.3	U	C
10	Housatonic River	From the Lenox Center STP and outlet of Woods Pond to the Lenoxdale STP, Lenox	45.0-43.6	1.4	U	C
11	Housatonic River	From Lenoxdale STP to the P.J. Schweitzer Paper Co. STP, Lee	43.6-42.0	1.6	U	C
12	Housatonic River	From P.J. Schweitzer Paper Co. STP to confluence with Goose Pond Stream	42.0-40.0	2.0	U	C

TABLE 12 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
13	Housatonic River	From confluence of Goose Pond Stream to the Lee STP	40.0-39.5	0.5	B	C
14	Housatonic River	From the Lee STP to the Laurel Mill, Hurlbut Paper Company	39.5-36.3	3.2	B	C
15	Housatonic River	From Laurel Mill to Willow Mill, Hurlbut Paper Company	36.3-35.3	1.0	B	C
16	Housatonic River	From Willow Mill, Hurlbut Paper Co., to confluence with Kampoosa Brook, Stockbridge	35.3-34.3	1.0	B	C
17	Housatonic River	From confluence, Kampoosa Brook, to inlet, Rising Pond, Great Barrington	34.3-24.7	9.6	U	B
18	Housatonic River	From inlet to outlet, Rising Pond	24.7-24.4	0.3	U	B
19	Housatonic River	From outlet, Rising Pond, to con-	24.4-23.3	1.1	B	B
20	Housatonic River	From confluence, Williams River to the Great Barrington STP	23.3-19.2	4.1	B	B
21	Housatonic River	From Great Barrington STP to confluence with Green River, Great Barrington	19.2-15.9	3.3	B	B
22	Housatonic River	From confluence, Green River, to confluence with Hubbard Brook, Sheffield	15.9-9.0	6.9	U	B
23	Housatonic River	From the confluence, Hubbard Brook, to the Mass.-Conn. state line	9.0-0.0	9.0	B	B
24	West Branch, Housatonic River	From its headwaters to confluence with the East Branch, Pittsfield	Above 55.4, 0.0	4.0	B	B
25	Southwest Branch, Housatonic River	From its headwaters to confluence with the West Branch, Pittsfield	Above 55.4, 0.8,0.0	0.8	B	C

TABLE 12 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
26	Goose Pond Stream	From the Westfield River Paper Co. outfall to confluence with Housatonic River, Lee	40.0-0.7	0.7	B	B
27	Goose Pond Stream	" " "	"	"	"	"
28	Williams River	From its headwaters to confluence with the Housatonic River, Great Barrington	Above 23.3, 0.0	10.1	B	B
29	Green River	From its headwaters to confluence with the Housatonic River, Great Barrington	Above 15.9, 0.0	9.4	B	B
30	Hubbard Brook	From its headwaters to confluence with the Housatonic River, Sheffield	Above 9.0, 0.0	2.3	U	B

Total Miles of Class B - 56.3
Total Miles of Class C - 0.0
Total Miles of Unsatisfactory Condition - 40.0

Inventory

Housatonic River Basin

Number of Lakes and Ponds	113
Surface area of Lakes and Ponds (in acres)	5,134
Number of Lakes and Ponds greater than 10 acres	70
Surface area of Lakes and Ponds greater than 10 acres	4,934
Number of officially recognized Great Ponds	17
Surface area of officially recognized Great Ponds (in acres)	2,882

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Pontoosuc Lake	Lanesborough/Pittsfield	11	S
Lake Buel	Monterey/New Marlborough	10	S
Lake Garfield	Monterey	9	S
Stockbridge Bowl	Stockbridge	9	S
Laurel Lake	Lee/Lenox	8	S
Richmond Pond	Pittsfield/Richmond	5	S
Onota Lake	Pittsfield	4	S
Upper Goose Pond	Lee/Tyringham	4	S
Plunkett Reservoir	Hinsdale	3	S
Goose Pond	Lee/Tyringham	2	S
Woods Pond	Lee/Lenox	12	U
Center Pond	Dalton	5	U
Ashmere Lake	Hinsdale/Peru	3	U

XIII - IPSWICH AND PARKER RIVER BASINS

The Ipswich River Basin is located in northeastern Massachusetts and encompasses a drainage area of 155 square miles. All or part of nineteen Massachusetts communities lie within the Ipswich drainage basin. The towns of Middleton, Topsfield, and North Reading lie completely within the basin, as do major portions of Boxford, Hamilton, North Andover, Reading, Wenham, and Wilmington.

The river rises in the Town of Burlington and follows a meandering northeasterly course to the Town of Ipswich, where it drains into the Atlantic Ocean. The major tributaries to the Ipswich River are Martin's Brook, Boston Brook, Fish Brook and the Miles River.

From its source to its mouth, the Ipswich River experiences a vertical fall of 115 feet, of which approximately 30 feet are taken up by the three dams on the river. At its mouth, the river has a total drainage area of 155 square miles and an average discharge of 249 cubic feet-per-second (cfs) to the Atlantic Ocean. The United States Geological Survey (USGS) maintains two flow gage stations on the Ipswich River. One is located in South Middleton and the other is located downstream at the Willowdale Dam in Ipswich. The average discharge at the South Middleton gage is 69 cfs, while the average discharge at the Ipswich gage is 198 cfs.

The total stream discharge is affected by several water supply diversions which occur regularly during high flow periods and intermittently during low flow periods. Beverly, Lynn, Peabody and Salem divert water from the Ipswich River to augment their water supplies. In addition, twelve other towns have water rights to the Ipswich River.

The Parker River Basin lies between the drainage basins of the Ipswich and Merrimack rivers in northeastern Massachusetts. All or part of nine communities lie within the 60 square mile area drained by the Parker River. The basin is generally rural-residential in nature, with only minor industrial development.

The Parker River rises at the confluence of two unnamed brooks in a wetland area in West Boxford. The river flows generally in a northeasterly direction through several small ponds and extensive wetland areas in the towns of Boxford, Georgetown, Groveland, and Newbury. In Newbury, the Parker River becomes tidal, with the last nine miles of the river subject to the rise of the tide. The Parker River flows through extensive saltwater marshes to its mouth where it empties into Plum Island Sound.

The Parker River is 21.3 miles long, drains 60 square miles, and has an average discharge into Plum Island Sound of 97.2 cfs. From its source to its mouth, the Parker River falls a total of 95 feet, of which 36 feet are taken up by the six dams located on the river.

The major topographic features of the Parker River Basin are low, rounded hills, freshwater wetlands, saltwater marshes and several small lakes and ponds which have formed in depressions in wetland areas. The surficial geology of the Parker River Basin was determined by the passage of one or more ice sheets during the Pleistocene Epoch and by the formation of alluvium and swamp deposits.

Water Quality Surveys

In the summer of 1973, the Division of Water Pollution Control conducted a water quality survey of the Ipswich River. During the weeks of June 4-8 and August 13-17, samples were collected four times daily from fifteen stations on the Ipswich River. Samples were collected for dissolved oxygen on three consecutive days. Composite samples were collected on Tuesday and Thursday of the above mentioned weeks for analysis of general water quality. During the survey, a photosynthesis study (light and dark bottle method) was undertaken at three river locations. Flow measurements were taken at various locations along the river during each week of survey.

During the week of June 30-July 4, 1975, the Division conducted a water quality survey of the Parker River and several of its tributaries. The survey was conducted under flow and dry weather conditions. The results of the survey do not reflect non-point sources of pollution which have impact upon water quality only under wet weather conditions. In comparison, the Ipswich River survey of 1973 was subject to wet weather conditions and reflected increased pollution loads from non-point sources.

Nine sampling stations were located on the mainstem Parker River and six stations were located on major tributaries. Samples were collected for temperature and dissolved oxygen analysis every four hours for three consecutive 24-your periods. Twenty-four hour composite samples for chemical analysis were collected during the first and third sampling days.

During both surveys, all analyses involving dissolved oxygen were analyzed at the field laboratory located at Bradley Palmer State Park in Topsfield. All other samples were conveyed for analysis to the Lawrence Experiment Station of the Department of Environmental Quality Engineering. The analyses were performed according to procedures of the American Public Health Association's Standard Methods for Examination of Water and Wastewater (13th edition 1971, New York). The results of the Ipswich River survey are available in the report, Ipswich River 1973 Water Quality Data. The results of the Parker River survey are available as an appendix in the report, Ipswich and Parker Rivers 1976, Water Quality Management Plan. Both reports were published by the Division and are available at the Division's Westborough office.

The Division conducted wastewater discharge surveys in 1976 and 1977 of the four major discharges located in the Ipswich and Parker River Basins. The results of these surveys are available in the report, The Parker and Ipswich Rivers 1976-77, Wastewater Discharge Data, published by the Division.

Segmentation

The Ipswich and Parker Rivers have each been divided into two segments--one representing the fresh water portion of the river and one representing the salt water portion. Table 13 gives a description of the segments, their present water quality condition and their water use classification. Mill River, a major tributary of the Parker River, is listed as a segment in Table 13.

Present Conditions

Segment 1 - Ipswich River from its headwaters in the Town of Wilmington to the rise of the tide at the Sylvania Dam, Ipswich - This segment has the low dissolved oxygen levels associated with waters flowing through extensive wetland areas at a sluggish pace. This condition is a natural phenomenon and, hence, not a violation of the water quality standards. Moderate coliform bacteria violations were periodically found in this segment. The fecal coliform bacteria levels were low, which suggests that the bacteria were mainly natural soil bacteria. With the exception of the periodic total coliform bacteria violations, this segment meets Class B standards.

Segment 2 - Ipswich River from the rise of the tide at the Sylvania Dam, Ipswich to its mouth in Ipswich Bay - This segment receives urban runoff and possibly illegal discharges from the center of the Town of Ipswich. The newly upgraded Ipswich STP discharges to Greenwood Creek which flows into this segment in Ipswich Estuary. Sampling prior to the upgrading of the STP showed high coliform bacteria levels in this segment. The levels are probably much reduced, but some may remain from the urban runoff and questionable discharges.

Segment 3 - Parker River from its source in Boxford to the rise of the tide in Newbury - A water quality survey in 1975 showed that one sampling station had severe water quality problems. At the inlet to Rock Pond in Georgetown, approximately four miles downstream from the river's source, extremely low dissolved oxygen levels, moderate ammonia and phosphorus levels, and moderate coliform bacteria levels were found during the 1975 survey. Upstream of this station, the river meanders for about three miles through a wetlands area which could account for the dissolved oxygen problems. The remainder of the segment met the Class B criteria with the exception of periodic total coliform bacteria violations.

Segment 4 - Parker River from the rise of the tide in Newbury to its mouth in Plum Island Sound - The dissolved oxygen levels in this segment were below the standards for Class SA waters. The coliform bacteria levels were also above the maximum criteria for a Class SA water.

Segment 5 - Mill River from its source in Georgetown to its confluence with the Parker River in Newbury - This segment met its Class B standards with the exception of coliform bacteria violations in the middle section of the segment in the Town of Rowley. The total and fecal bacteria levels were moderately high, indicating probable urban runoff and septic leachate problems.

TABLE 13

IPSWICH AND PARKER RIVER BASINS

CLASSIFICATION - SEGMENTATION

NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Ipswich River	From its headwaters in Burlington to the rise of the tide in Ipswich	41.1-4.5	36.6	U/B	B
2	Ipswich River	From the rise of the tide in Ipswich to its mouth in Ipswich Bay	4.5-1.1	3.4	X	SA
3	Parker River	From its source in Boxford to the rise of the tide in Newbury	21.3-9.0	12.3	U/B	B
4	Parker River	From the rise of the tide in Newbury to its mouth in Plum Island Sound	9.0-0.0	9.0	U	SA
5	Mill River	From its source in Georgetown to its confluence with the Parker River	9.6-0.0	9.6	U/X	B/SA

U - Does not meet standards - 67.5 miles

X - Condition not known - 3.4 miles

LAKES AND PONDS

In the summer of 1976, three baseline water quality surveys were conducted on Martin's Pond which is located within the Ipswich River Basin in the Town of North Reading. The results of these lake studies are available at the office of the Division of Water Pollution Control in Westborough.

Inventory

Ipswich/Parker River Basins

	River Basin	
	Ipswich	Parker
Number of Lakes and Ponds.....	75	18
Surface area of Lakes and Ponds (acres).....	1,980	343
Number of Lakes and Ponds greater than 10 acres.....	36	10
Surface area of Lakes and Ponds greater than 10 acres...	1,775	300
Number of officially recognized Great Ponds.....	5	4
Surface area of officially recognized Great Ponds (acres)	213	209

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Martin's Pond	North Reading	9	U

XIV - THE ISLANDS

Martha'a Vineyard and Nantucket are considered in the same basin plan because of similar geologies, water resources, and water quality problems. Ponds constitute the major form of surface freshwater resources and groundwater is the sole source of drinking water on both islands. With two exceptions, the coastal waters meet all standards for Class SA seawater.

Nantucket is an island of 49.5 square miles, 94 miles of coastline, and a maximum elevation of about 100 feet. Its 1975 year-round population was 5,540 (a 47% increase since 1970), and the summer population is quickly approaching 30,000. The island is host to about 500,000 tourists a year. Potential threats to the quality of the island's groundwater are rapid growth with reliance on septage systems, leachate from landfill disposal of septage and solid wastes, and salt water intrusion. Coastal waters are threatened by possible oil spills from tanker traffic and offshore oil exploration, and by sanitary waste discharge from watercraft, especially in harbors.

There are no industrial wastewater discharges on Nantucket. A thermal discharge to Nantucket Harbor presently meets water quality standards. Discharges of untreated sanitary wastes to Nantucket Harbor occur occasionally from the Sea Street Pumping Station and has resulted in the closure of 24 acres to shellfish harvesting, but will be reopened upon upgrading of the pumping system. At present, the island utilizes two sand beds for sanitary waste treatment with subsequent landfill disposal. Plans call for the completion of four secondary treatment plants (1982 and 1988) to serve the four most densely populated areas of the island.

Martha's Vineyard is an island consisting of seven towns--one town, Gosnold, being located on the separate Elizabeth Islands. Total surface area is 105.9 square miles with 125 miles of shoreline and a maximum elevation of about 130 feet. The 1975 year-round population was 7,900 and the summer population was about 55,000.

Potential water quality problems are similar to those on Nantucket: heavy use of septic systems, landfill leachate, watercraft waste, stormwater runoff, and oil spillage.

The only discharge covered by NPDES is a thermal industrial discharge which has been found to be well within permit limits; however, there are a few other small discharges not presently covered.

Presently there are two sanitary waste treatment plants on Martha's Vineyard, one of which discharges to a sand bed and the other to a leaching field.

The Town of Gosnold on the Elizabeth Islands has two small untreated sewage discharges which impact the coastal area adjacent to the discharge. To guard against future deterioration of groundwater supplies, current efforts and planning are concentrated towards methods to dispose of increasing amounts of nightsoil, and towards upkeep of existing septic systems.

Water Quality Surveys

The Division surveyed surface water and groundwater quality and wastewater discharges on Martha's Vineyard on eight separate occasions between August 1975 and December 1976. The data has been published in the report Martha's Vineyard Water Quality Study 1975-1976. No water quality surveys have been conducted on the waters of Nantucket. A wastewater discharge was conducted in 1976, but the results have not been published.

The overall water quality, fresh and coastal, of both islands is excellent. Land use management and water quality monitoring should insure that this remains so.

Segmentation

All surface waters on Martha's Vineyard and Nantucket come under the anti-degradation section of the State's water quality standards, and, as such, there is no surface freshwater segmentation. Coastal waters are all classified SA, except for one small area each, off Gosnold and in Nantucket Harbor. The segment numbers are part of a statewide coastal segment numbering system.

Present Conditions

Segment 117 - Nantucket Harbor -The primary reason for the SC classification of the harbor is its high coliform count. Twenty-four acres of the harbor have been closed to shellfishing and contact recreation. The Sea Street Pumping Station has an overflow bypass to the harbor which discharges untreated sewage occasionally and which will be eliminated upon completion of the upgrading of the Surfside Wastewater facility. Control of bacterial contamination from watercraft discharge of sanitary wastes is being investigated with the possible construction of a dockside pump-out facility.

Segment 118 - Gosnold - Two small untreated sewage discharges are responsible for its SC classification, as a result of high coliform counts. Facilities planning has been initiated to alleviate this problem and to provide for future waste treatment needs.

TABLE 14

THE ISLANDS

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	DESCRIPTION	PRESENT CONDITION	CLASSIFICATION
117	Nantucket Harbor	SC	SA
118	Gosnold	SC	SA

Segments meeting Class SC - 2

LAKES AND PONDS

There are 103 lakes and ponds in the Island's Basin.

Inventory

Island Basin

	Elizabeth Islands	Martha's Vineyard	Nantucket	Total
Number of Lakes and Ponds	13	62	28	103
Surface area of Lakes and Ponds (acres)	324	6,146	952	7,422
Number of Lakes and Ponds greater than 10 acres	5	42	17	64
Surface area of lakes and ponds greater than 10 acres	299	6,011	885	7,195
Number of officially recognized Great Ponds	0	4	2	6
Surface area of officially recognized Great Ponds (acres)	0	1,429	506	1,935

(Included in this inventory are some saltwater and brackish ponds.)

Classification

No lakes or ponds have been classified for the Islands as yet.

XV - THE MERRIMACK RIVER

The Merrimack River is the second largest river, in terms of flow, in Massachusetts. Beginning in Franklin, New Hampshire, at the confluence of the Pemigewasset and Winnipesaukee rivers, the Merrimack flows a total of 116 miles to the Atlantic Ocean at Newburyport and Salisbury, draining an area of some 5,000 square miles. The lower 50 miles of the river and approximately 1,200 square miles of the drainage area lie in Massachusetts. Of the 50 miles of river in Massachusetts, the last 22 are tidal.

The Massachusetts portion of the basin has long been a manufacturing center. Historically, the manufacture of textiles, and later paper, played a dominant role in the growth of the three largest cities in the basin--Lowell, Lawrence, and Haverhill. The river, in turn, played a major role in the growth of industry as a source of power. The two dams on the river in Massachusetts--Pawtucket Dam in Lowell, and Essex Dam in Lawrence--were built to provide power through canal systems. Another city on the river, Newburyport, also relied on the river as an impetus to growth; the Merrimack estuary provided a somewhat protected harbor for fishing boats from that city.

The industrial growth of the basin carried with it the inevitable by-product of water pollution. A secondary function of the river in industrial areas was to carry away process and domestic wastes. Due to the large volume of flow in the Merrimack, the river was felt to have an unlimited capacity for carrying liquid wastes. Even in the early twentieth century, when the problems of water pollution were being recognized, and pollution abatement facilities were being built in several Massachusetts cities, it was felt that such actions were unnecessary on large rivers like the Merrimack.

Meanwhile, due to the lack of sufficient groundwater sources, the cities of Lowell and Lawrence came to rely on the river as a source of public water supply. Water treatment plants which were, in their day, the most advanced in the country were built in both cities to treat Merrimack River water. Despite the numerous untreated waste discharges in Massachusetts and upstream in New Hampshire, the river managed until recently to support a variety of uses. A bathing beach in Lowell was used until the 1960's. The shellfish beds in the estuary have gradually been restricted or closed. Sport fishing and boating still take place in the estuary, although the run of anadromous fish today is but a shadow of what it once was.

Although references to the pollution of the Merrimack date back to Thoreau, serious concern over the problem is a fairly recent phenomenon. Several major studies were undertaken during the 1960's by the federal Water Pollution Control Administration, the Massachusetts Department of Public Health, and Camp, Dresser and McKee Consulting Engineers. These studies led to the requirements for all of the Massachusetts communities on the Merrimack to provide secondary treatment to their wastes. It is somewhat ironic to note that much of the early development of the activated sludge treatment process took place at the Lawrence Experiment Station on the banks of the Merrimack in the 1890's. Seventy years later, that process is the most widely used in sewage treatment plants all over the world, but such facilities are just now being completed within the basin.

New treatment facilities have recently gone on line in Lawrence, Haverhill, and Amesbury, while other plants are under construction in Lowell, Merrimac, Salisbury, and Newburyport. Although major improvements have resulted, the total effect will not be known until all plants are completed and functional.

Water Quality Surveys

The Merrimack River has been surveyed approximately every ten years since 1850. In 1964 the U.S. Public Health Service conducted a sampling and analysis program in cooperation with several state agencies including the Department of Public Health. The Division of Water Pollution Control sampled the Merrimack River in 1974. The results of that survey were published in a report entitled The Merrimack River Part A, 1974 Water Quality Data. A separate survey was also conducted on Stony Brook, a tributary to the Merrimack, and that data was published in a report entitled The Stony Brook Part A, 1974 Water Quality Data.

The Division of Water Pollution Control also samples all major permitted discharges and a percentage of the minor permitted discharges. The most recent results of this sampling are published in a report entitled The Merrimack River Part B 1977 Wastewater Discharge Data.

Segmentation

The Merrimack River Basin has been divided into segments based on assigned water use classifications, existing waste discharges, and in-stream water quality. Only those streams in the basin with existing discharges have been segmented. The segments are listed in Table 15 together with the segment classifications and present condition. A more detailed explanation of the present condition of each segment follows:

Present Conditions

Segment 1 - Mass.-N.H. line to Tyngsborough Bridge - Problems in this segment are caused by discharges in New Hampshire and by the Nashua River which flows into the Merrimack at Nashua, New Hampshre. High coliform bacteria concentrations and relatively high nutrient concentrations are present, but the river's assimilative capacity tempers the effect that the total oxygen demand of the waste has on the dissolved oxygen of the stream. Nutrient levels contribute to a slight algal condition. The floating solids present indicate the discharge of raw and/or inadequately treated sewage upstream.

Segment 2 - Tyngsborough Bridge to Pawtucket Dam - Discharges in Chelmsford and Lowell together with the waste load from upstream contribute to algal blooms in this segment. The dissolved oxygen is generally lower in this segment than in Segment 1, but the problem is only a slight one as the oxygen demand of the waste load is being exerted. Bacteria concentrations are much lower but still exceed water quality standards. The existence of algal problems is verified by the diurnal fluctuation of the dissolved oxygen and the high concentrations of green and blue-green algae present throughout this segment.

Segment 3- Pawtucket Dam to Fish Brook, Andover - Untreated municipal and industrial waste water is discharged into the Merrimack at Lowell. Moderately low dissolved oxygen concentrations are present throughout the segment. Gen-

erally, the upper half of the segment is of lower quality than the lower half. Coliform bacteria concentrations are quite high just below Lowell, but they decrease to a much lower level near Fish Brook. Floating solids are a slight problem below Lowell. Serious algal conditions exist and contribute to mid-depth dissolved oxygen problems. The improvement in water quality from Lowell to Fish Brook and the fact that water quality standards are not grossly violated indicates the huge assimilative capacity of the Merrimack.

Segment 4 - Fish Brook to the Dam in Lawrence - Algal problems caused by the nutrient and carbonaceous load from upstream discharges are critical. The dam serves to concentrate the algae which multiplies the problems. Dissolved oxygen levels are critically low at mid-depth levels, while the surface concentrations show a wide diurnal fluctuation under serious bloom conditions. Turbidity is high even with low algal concentrations. Coliform bacteria concentrations do not conform to water quality standards but are only a slight problem in this segment.

Segment 5 - From the Dam in Lawrence to Creek Brook, Haverhill - Treated municipal and industrial waste waters from the communities of the Greater Lawrence Sanitary District are discharged into the Merrimack in this segment. Coliform bacteria concentrations remain critical due to upstream discharges. Some improvement in dissolved oxygen levels are evident. However, in general the effects of the new treatment facility are over-shadowed by upstream discharges.

Segment 6 - From Creek Brook to the Rocks Village Bridge - Treated wastewater from Haverhill are discharged within this reach. Bacteria concentrations are similar to those in Segment 5. Dissolved oxygen concentrations are low. Conditions at the lower portion of the reach are somewhat improved due to the greater volume of water brought in by the tide. Bacteria concentrations drop and the solids problem is not nearly as visible as it is upstream. The dissolved oxygen level is higher but still remains very low. Algae concentrations are higher in the lower end of the segment. However, even the much greater volume of water present at the lower end of the segment is not able to fully temper the effects of the upstream discharges.

Segment 7 - From the Rocks Village Bridge to the Atlantic Ocean - Bacteria concentrations steadily decrease even with the addition of several small discharges in this segment. This is due mainly to the increasing volume of water present as the segment reaches the Atlantic Ocean. Moderate dissolved oxygen problems remain right into the Newburyport Harbor and then disappear dramatically at the mouth of the river. The major influence in this segment is its tidal nature. The large volume of water present at all times and the flushing action of the tide "treat" the remaining pollutants.

Segment 8 - The Basin - Slight bacteria and dissolved oxygen problems caused by upstream discharges keep this segment from achieving its assigned water use classification (SA).

Segment 9 - Stony Brook - A moderate oxygen problem is caused by the Chelmsford discharges. Nutrient concentrations contribute to a slight algal problem. A slight bacteria problem becomes very serious just before the confluence with the Merrimack River. Industrial discharges in Chelmsford cause serious color and turbidity problems in the lower portion of this segment.

Segment 10 - Beaver Brook - Upstream discharges from New Hampshire together with discharges in Dracut and Lowell create very high bacteria concentra-

tions and a slight solids problem. Dissolved oxygen concentrations remain relatively high due to the steep gradient of the brook and the resultant reaeration.

Segment 11 - Spickett River from Mass.-N.H. Line to the Route 28 Bridge, Lawrence - Discharges from Salem, New Hampshire, are expected to cause moderate oxygen, bacteria, and nutrient problems. The Environmental Protection Agency is preparing a report on the Spickett River which will detail the water quality in this segment.

Segment 12 - From the Route 28 Bridge to its mouth at the Merrimack River - Severe water quality problems exist in this segment due to the discharge of large quantities of raw sewage and industrial waste water. One such discharge in the lower portion of the segment more than doubles the flow in the stream. Color and solids are very high in the segment. Bacteria concentrations are well in excess of 1,000,000 per 100 ml. Dissolved oxygen levels are low and the diurnal fluctuation in the levels indicates the presence of algae.

Segment 13 - Little River from Mass.-N.H. Line to the Winter Street Bridge, Haverhill - The Merrimack River Basin Water Quality Management Plan by the State of New Hampshire indicates that discharges in Plaistow, N.H. degrade this segment to Class C (assigned water quality standard is B).

Segment 14 - Little River from the Winter Street Bridge to its mouth at the Merrimack River - At times, the dissolved oxygen concentration is 0.0 in this segment due to its low flow and the many discharges that go into it. Color, solids, and turbidity are very high. Coliform bacteria concentrations are very high as this segment is little more than a sewer for the wastewater in the immediate area.

Segment 15 - Cobbler Brook - This segment receives sewage and industrial waste from the Town of Merrimac which degrades it to a Class C stream.

Segment 16 - Powwow River from Mass.-N.H. Line to 1.25 miles from its mouth - This segment is degraded in Amesbury Center by runoff and municipal and industrial discharges to a Class C stream.

Segment 17 - Tidal portion of the Powwow River - Discharges in Amesbury, which cause slight bacteria and oxygen problems, prevent this segment from meeting its assigned water use classification (SB).

Segment 18 - Black Rock Creek - Chlorinated sewage from Salisbury causes severe problems in this segment. High solids and color are present and the dissolved oxygen is very low. Coliform bacteria concentrations are very high. The flow in this segment is too low to handle the waste load from Salisbury.

Segment 19 - Plum Island River - There are insufficient data on this segment to make an accurate water quality assessment, but it is expected that the unsewered areas of Newbury and Plum Island cause slight problems in this segment which prevent it from meeting its SA classification.

Shawsheen River -

Segment 6 - Maguire Road to confluence with Spring Brook - Water quality of this segment was generally good when sampled in 1974. Dissolved oxygen

concentrations were well above assigned Class B standards. The bottom consisted of a sandy-rocky type substrate with moderate aquatic vegetation present.

Segment 5 - Confluence with Spring Brook to Boston Road, Route 3A - There appeared to be no adverse effect to the water quality conditions associated with the Bedford Veteran's Administration Hospital wastewater treatment plant discharge into Spring Brook. D.O. concentrations were relatively high during both surveys. A rocky type substrate with many riffle areas aided in adding dissolved oxygen. However, just below Route 62, the Shawsheen River flows into its first swampy reach. The substrate in this stretch was covered with a dense growth of submerged aquatic vegetation. Diurnal dissolved oxygen fluctuations occurred. This stretch characterizes an extreme case of natural degradation of water quality caused by the decomposition of organic matter found in the marsh.

Segment 4 - Boston Road, Route 3A, to Shawsheen Road to the USGS Gage - This reach was also very swampy and slow moving. Average D.O. concentrations improved somewhat, but were still below standards.

Segment 3 - Shawsheen Road at the USGS Gage to Mill Street - The average dissolved oxygen concentration was found to be below standards. This was attributed to the marshy reach just above. Fluctuations in dissolved oxygen values indicated photosynthetic activity.

Segment 2 - Mill Street to Horn Bridge - A severe sag in dissolved oxygen values occurred within this segment. This was attributed to the decomposition of organic matter, coupled with the Shawsheen's slow travel time through this swampy stretch.

Segment 1 - Horn Bridge to confluence with Merrimack River - Average dissolved oxygen concentrations of this reach were relatively good. However, there were fluctuations of D.O. levels. The substrate was generally composed of rocks and gravel with a few riffle areas helping to add oxygen to the river.

TABLE 15

MERRIMACK RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Merrimack River	N.H.-Mass. state line to Tyngsborough bridge, Tyngsborough	49.82-47.35	2.47	U	C
2	Merrimack River	Tyngsborough Bridge to Pawtucket Dam, Lowell	47.35-40.60	6.75	U	B
3	Merrimack River	Pawtucket Dam to Fish Brook, Andover	40.60-33.03	7.57	U	C
4	Merrimack River	Fish Brook to dam in Lawrence	33.03-29.0	4.03	U	B
5	Merrimack River	Dam in Lawrence to Creek Brook, Haverhill	29.0-21.85	7.15	U	C
6	Merrimack River	Creek Brook to Rocks Village Bridge, Haverhill-West Newbury	21.85-11.80	10.05	U	SC
7	Merrimack River	Rocks Village Bridge to Atlantic Ocean	11.80-0.0	11.80	U	SB
8	Merrimack River	The Basin in the Merrimack River Estuary, Newbury-Newburyport	---	---	SC	SA
9	Stony Brook	Outlet of Forge Pond, Westford, to confluence with Merrimack River, Chelmsford	10.3-0.0	10.30	C	B
10	Beaver Brook	N.H.-Mass. line to confluence	4.2-0.0	4.20	C	B
11	Spickett River	N.H.-Mass. line to Route 28 bridge, Lawrence	6.4-2.8	3.60	C	B
12	Spickett River	Route 28 bridge to confluence	2.8-0.0	2.80	U	C
13	Little River	N.H.-Mass. line to Winter Street bridge, Haverhill	4.3-0.48	3.82	C	B

TABLE 15 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
14	Little River	Winter Street bridge to confluence	0.48-0.0	0.48	U	B
15	Cobbler Brook	Entire length	3.67-0.0	3.67	C	B
16	Powwow River	N.H.-Mass. line to the point 1.25 miles from confluence with Merrimack River	6.4-1.25	5.15	C	B
17	Powwow River	Point 1.25 miles upstream to confluence	1.25-0.0	1.25	SC	SB
18	Black Rock Creek	Entire length	1.70-0.0	1.70	U	SB
19	Plum Island River	Plum Island Sound & Parker River to confluence	3.6-0.0	3.60	SB	SA
6	Shawsheen River	Maguire Rd. to confluence, Spring Brook	25.0-23.3	1.70	C	B
5	Shawsheen River	Confluence with Spring Brook to Boston Road, Route 3A	23.3-19.4	3.90	C	B
4	Shawsheen River	Boston Rd., Rte. 3A, to Shawsheen Rd. at USGS gage	19.4-16.0	3.40	C	B
3	Shawsheen River	Shawsheen Rd. at USGS gage to Mill St.	16.0-12.2	3.80	C	B
2	Shawsheen River	Mill St. to Horn Bridge	12.2-5.9	6.30	C	B
1	Shawsheen River	Horn Bridge to confluence with Merrimack River	5.9-0.0	5.90	C	B

Total Miles of Class SB - 3.60
Total Miles of Class C - 55.74
Total Miles of Class SC - 1.25
Total Miles of Unsatisfactory Conditions - 54.80

LAKES AND PONDS

There are 94 lakes and ponds in the Merrimcak River Basin. Intensive studies are being conducted on Lake Attitash, Flint Pond and Wabnasset Pond. Baseline water quality studies have been conducted on Flushing Pond, Long Sought-for Pond, and Mill Pond. Results are available at the Westborough office.

Inventory

Merrimack River Basin

Number of Lakes and Ponds	94
Surface area of Lakes and Ponds (in acres)	4,429
Number of Lakes and Ponds greater than 10 acres	50
Surface area of Lakes and Ponds greater than 10 acres	4,188
Number of officially recognized Great Ponds	14
Surface area of officially recognized Great Ponds (in acres)	1,457

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Keyes Pond	Westford	9	S
Flushing Pond	Westford	7	S
Long Sought-for Pond	Westford	6	S
Mill Pond	Littleton	12	U
Ames Pond	Tewksbury	7	U
Flint Pond	Tyngsborough	7	U

XVI - MILLERS RIVER BASIN

The Millers River is formed in Winchendon by the confluence of the North and South Branches. The North Branch begins in New Ipswich, New Hampshire, while the South Branch begins in Ashburnham, Massachusetts. The main stem of the Millers River flows generally westward through Winchendon, Templeton, Royalston, Athol, Orange, Erving, and Montague, joining the Connecticut River just below the French King Bridge in Gill.

Major tributaries are the Otter River which enters in Winchendon, and the Tully River which enters in Athol. The Tully and Millers rivers are considered as potential sources of water supply, although the Otter River has an adverse effect upon the water quality of the Millers River at present.

The Millers River drains a total area of 390 square miles, of which about 350 are in Massachusetts. The population of the Massachusetts area was 57,000 in 1970. Average flow entering the Connecticut River from the Millers is 620 cubic feet-per-second.

The United States Army Corps of Engineers operates two flood control dams in the Millers Basin--Birch Hill Dam on the Millers River and Tully Dam on the Tully River. Other dams are located in Winchendon, Athol, Orange, and Millers Falls. The United States Geological Survey maintains seven flow gaging stations on the Millers River and its tributaries.

Major sources of pollution include paper mills in Templeton (discharging to the Otter River) and Erving. Sewage treatment plants are located in Winchendon, Athol, Orange, Erving and Millers Falls on the Millers River. The Gardner Sewage Treatment Plant and the Seaman Paper Company Wastewater Treatment Plant discharge to the Otter River, and the Fernald State School Sewage Treatment Plant discharges to Beaver Brook in Templeton.

The Otter River is grossly polluted by the discharge from the Baldwinville Products paper mill. This carries over into the Millers River and causes serious degradation of water quality throughout the Millers River. The recently completed wastewater treatment plant in Erving provides a high degree of treatment for wastes from the Erving Paper Company. This has alleviated conditions in the lower reaches of the Millers River to a considerable extent.

The new treatment facility for the discharge from Baldwinville Products will go on line during 1978. This will cause a remarkable rise in water quality in the Millers Basin. Additional levels of treatment at Gardner and Athol will probably be necessary before water quality in the Millers Basin fully meets Class B criteria.

Water Quality Surveys

In the summer of 1973, the Division conducted an intensive water quality survey of the Millers and Otter rivers. The survey consisted of 24-hour sampling during three days in each of two weeks at 15 locations. Photosynthesis studies were conducted during the same period. The results of this survey have been published in a report entitled Millers River Study 1973 - Part A.

In 1971 the Division awarded a contract to Tighe and Bond, Inc., of Holyoke for the purpose of sampling all significant waste discharges in the Connecticut River Valley. This study included the significant discharges in the Millers River Basin. All discharges were sampled for a 24-hour period on each of three days. The results of this study can be found in a report entitled Wastewater Discharge Survey, Connecticut River Basin.

The data collected is discussed in detail in the Millers River Study 1973 - Part C. Although the report centers around the analysis of this data, it also contains portions on the history of the basin, water supply, recreation, and a description of planning efforts being conducted in the basin.

All major wastewater discharges in the Millers Basin have been sampled annually since 1975. The most recent data can be found in a report titled The Millers River Part B, 1977 Wastewater Discharge Data.

A major water quality survey will be carried out in the Millers River Basin during the summer of 1979.

Basin Segmentation

In order to define the present problems, the major streams of the basin have been broken down into a number of segments. These segments are listed in Table 16.

Along the main stem Millers and Otter rivers, a segment division occurs at each classification change, at each major wastewater treatment facility and at the confluence with each major tributary. Beaver Brook is segmented from the Fernald State School Sewage Treatment Plant discharge to the confluence with the Millers River.

Table 16 also lists the present condition and future use classification for each segment. The future use classification is based on the present water quality standards, while the present condition is based on the results of the 1973 water quality surveys and an assessment of improvements due to treatment facilities brought on line since 1973. The following is a summary of the present condition of each segment:

Present Condition

Otter River -

Segment 2 - Above Gardner STP - This segment has severe D.O. problems and moderate suspended solids problems. Although this segment is proposed to be Class B, the present D.O. levels barely reach Class C criteria. The major problems associated with this segment are lack of aeration and the decay of vegetative matter in the river's swampy headwaters. During periods of heavy precipitation, there are overflows and bypasses in the Gardner sewer system which also degrade the quality of this segment.

Segment 3 - Gardner STP to Seaman Paper Company - Severe nutrient and coliform problems along with a moderate solids and D.O. problem combine to degrade the water quality in this segment below Class C levels. The problems in this segment are caused by the discharge from the Gardner STP.

Segment 4- Seaman Paper Company to Baldwinville Paper Products - The problems associated with this segment are primarily due to carryover effects from Segment 3. The same parameters are violated, but to a lesser degree.

Segment 5 - Baldwinville Paper Products to Millers River - All seven categories are violated in this segment. Dissolved oxygen, solids, and pH are severe problems; temperature and floating solids are moderate problems; while coliform and nutrients are minor problems. Consequently, the water quality in this segment is far below the criteria for Class Cl. The discharge from Baldwinville Paper Products is the reason for these conditions.

Millers River -

Segment 0 - Above Winchendon STP - The upper reaches of the Millers River are classified as A and B waters. For the most part, criteria for these classifications are being met. The exception is below Winchendon Center where occasional high coliform counts are caused by runoff.

Segment 1 - Winchendon STP to Otter River - This segment is now meeting its assigned Class B criteria.

Segment 6 - Otter River to South Royalston USGS gage - This segment has severe D.O. and solids problems, moderate problems with floating solids, and minor coliform bacteria problems. These problems prevent the river from meeting Class C criteria and are a carryover of the conditions present in the Otter River.

Segment 7 - South Royalston gage to Tully River - The problems in the upstream portion of this segment are similar to those of Segment 6 and due to the same reasons. This segment has a large assimilative capacity and, therefore, the downstream portion of this segment is near the B classification assigned to it.

Segment 8 - Tully River to Orange Center - This segment has moderate coliform bacteria, D.O., and nutrient problems as well as minor solids and floating solids problems. These problems are caused by the discharge from the Athol WWTP and prevent this segment from meeting its assigned B classification.

Segment 9 - Orange Center to Erving Paper Company - Raw wastewater discharges from Orange have been eliminated, but some problems are caused by carryover effects from Segment 8. This segment essentially meets its assigned B classification.

Segment 10 - Erving Paper Company to Millers Falls Paper Company - Severe D.O. and solids problems along with minor pH and coliform bacteria problems prevent this segment from meeting Class B criteria. These problems originate at the raw discharge from Erving Paper Company.

Segment 11 - Millers Falls Paper Company to Millers Falls Dam - The problems associated with this segment are similar to those of Segment 10, and in large part they are due to carryover effects. This segment also falls below its assigned B classification.

Segment 12 - Millers Falls Dam to Connecticut River - Solids and color problems are still severe in this segment. However, dissolved oxygen problems are less significant. Again, the water quality is below Class B criteria.

Segment 13 - From the Fernald School discharge to the Millers River - This treatment facility does not provide adequate treatment and some degradation at Beaver Brook is the result. Thus, the water quality in Beaver Brook does not fully meet Class B criteria.

LAKES AND PONDS

The Division has completed an intensive survey on Lake Mattawa in Orange. A joint intensive survey with the State of New Hampshire has been completed on Lake Monomonac in Winchendon, Massachusetts and Rindge, New Hampshire. Baseline lake surveys have not been carried out in the Millers Basin.

Inventory

Millers River Basin

Number of Lakes and Ponds	107
Surface area of Lakes and Ponds (acres)	4,435
Number of Lakes and Ponds greater than 10 acres	72
Surface area of Lakes and Ponds greater than 10 acres (acres)	4,251
Number of officially recognized Great Ponds	2
Surface area of officially recognized Great Ponds (acres)	74

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Lake Mattawa	Orange	5	S
Lake Monomonac	Winchendon/Rindge, N.H.	7	U

TABLE 16

MILLERS RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
0	Millers River	Above Winchendon STP	Above 35.7	6.5	B	B
1	Millers River	Winchendon STP to confluence, Otter River	35.7-30.4	5.3	B	B
2	Otter River	Above Gardner STP	Above 9.7	2.5	C	B
3	Otter River	Gardner STP to Seaman Paper	9.7-5.3	4.4	U	C
4	Otter River	Seaman Paper to Baldwinville Products	5.3-3.9	1.4	U	C
5	Otter River	Baldwinville Products to confluence, Millers River	3.9-0.0	3.9	U	C1
6	Millers River	Otter River to South Royalston USGS Gage	30.4-25.6	4.8	U	B1
7	Millers River	South Royalston USGS gage to Tully River	25.6-19.1	6.5	U	B
8	Millers River	Tully River to Orange	19.1-13.6	5.5	C	B
9	Millers River	Orange to Erving Paper	13.6-8.1	5.5	B	B
10	Millers River	Erving Paper to Millers Falls Paper	8.1-2.3	5.8	C	B
11	Millers River	Millers Falls Paper to Falls Dam	2.3-1.8	0.5	C	B
12	Millers River	Millers Falls Dam to confluence with Connecticut River	1.8-0.0	1.8	C	B
13	Beaver Brook	From Fernald School to Millers River	3.1-0.0	3.1	C	B

Total Miles of Class B - 17.3
Total Miles of Class C - 19.2
Total Miles of Unsatisfactory conditions - 21.0

XVII - THE NASHUA RIVER BASIN

The Nashua River, located in north central Massachusetts and southern New Hampshire, consists of a north branch and a south branch which combine in Lancaster, Massachusetts to form the main stem. The river then flows in a northeasterly direction until it joins the Merrimack River in Nashua, New Hampshire. The river's 530 square mile drainage area lies primarily within Worcester and Middlesex counties in Massachusetts and includes the 115 square mile watershed of the Metropolitan District Commission's Wachusett Reservoir. However, only twelve million gallons of water per week are released to the south branch from this reservoir. As a result, the Wachusett watershed has only minor importance with respect to the rest of the river basin.

From the headwaters of the north branch in Fitchburg to the confluence with the south branch, a distance of nineteen miles, the river elevation drops 360 feet. The main stem then falls another 110 feet along its remaining 37 mile course to the Merrimack River. The United States Geological Survey maintains a single flow gaging station on the main stem at East Pepperell. The flow at this station over the past forty years averaged 560 cubic feet-per-second (cfs). Gaging stations are located on the North Nashua River in Leominster and Fitchburg. The average flow at the Leominster gage over the same forty year period was 193 cfs. The new gage at Fitchburg showed an average yearly flow of 141 cfs for 1976.

All or a portion of twenty-six Massachusetts cities and towns lie within the Nashua River Basin. The two largest municipalities are Fitchburg and Leominster with populations of 41,718 and 36,030 respectively (1975). These two cities, located on the north branch, contribute a major portion of the domestic waste load discharged to the river.

The North Nashua River rises in Fitchburg at the confluence of Flag Brook and the outlet of Snows Millpond. The river flows in a southeasterly direction through Fitchburg and Leominster encountering twelve dams before it joins the south branch in Lancaster. Wastewater discharges along the north branch are cooling water, industrial process wastewater, sewage treatment plant effluent and combined sewer overflow.

Wachusett Reservoir in Clinton is the source of the South Nashua River. Counterpane Brook is its main tributary. The south branch is polluted by industrial cooling and process wastewater and combined sewer overflow. The major source of pollution is the effluent from the Clinton Sewage Treatment Plant which contributes a large portion of the river's flow at its point of entry.

The main stem flows sluggishly from Lancaster to the Massachusetts border. It encounters a dam in Ayer and another one in East Pepperell. Behind the dam in East Pepperell is a large impoundment known as Pepperell Pond. Pollution on the main stem of the Nashua River results from industrial process effluent, raw sewage, and treated domestic wastewaters. However, the pollution to which the main stem is subjected is minor in comparison to that of the north branch. Land along this stretch of the river is largely undeveloped. Therefore, ignoring the water quality, the river basin is very scenic. The Squannacook River, the southern-most of the main stem's two major tributaries, receives effluent from two paper mills along the last five miles of its course. The Nissitissit River is one of the cleaner rivers in the state.

Water Quality Surveys

The most recent water quality survey on the Nashua River Basin was conducted by the Division of Water Pollution Control during the summer of 1977. This survey collected water samples from 71 stations on the North Branch, South Branch, and main stem of the Nashua River and its major tributaries. Each one-week survey consisted of 24-hour sampling during three days around the clock for chemical analysis and dissolved oxygen level determinations. Phytoplankton and bacteriological samples were also collected. The data from this survey will be presented in a report entitled The Nashua River Part A, Water Quality Data which will be published in the near future by the Division of Water Pollution Control. As an additional part of the 1977 water quality surveys of the Nashua River Basin, the biological section of the Division conducted a macroinvertebrate survey at 16 stations. The results of this survey will be published at a later date. Effluent discharge surveys were also conducted during the summer of 1977. Fifteen wastewater discharges were sampled and analyzed in accordance with guidelines established by the U.S. Environmental Protection Agency. The results of these discharge surveys will appear in a report entitled Nashua River Part B Wastewater Discharge Data 1977 which will be published by the Division of Water Pollution Control.

During the summer of 1973 a less intensive water quality survey was conducted by the Division of Water Pollution Control. Data from this survey appear in the document titled Nashua River Water Quality Survey Data 1973.

Segmentation

On the basis of water use classifications, wastewater discharge locations or other significant changes in water quality and stream hydraulics, the Nashua River and its major tributaries are divided into 23 segments as shown in Table 17. The present water use classifications and the present water quality conditions are also shown in this table. The revised water quality standards for Massachusetts propose that the North and South branches, the main stem, and its tributaries be designated as Class B waters. However, these updated standards are currently under review and will be finalized at a later date.

Present Conditions

Segment 1 - Confluence of North and South Branches to the Ice House Dam - Most of this segment flows through the undeveloped portion of the Fort Devens military reservation (including the Oxbow National Wildlife Refuge). However, high coliform bacteria levels and moderate amounts of ammonia and phosphorus from upstream discharges and some stormwater runoff at the lower end of the segment prevent this water from meeting the standards for a Class B segment.

Segment 2 - Ice House Dam to Pepperell Dam - Although this segment is in a largely undeveloped area, coliform bacteria and nutrient levels prevent this segment from meeting Class B criteria. These violations are the result of non-point source pollution from urban runoff from Fort Devens, agricultural runoff in Ayer and Groton, and a sanitary landfill in Groton which is located adjacent to the banks of the river.

Segment 3 - Pepperell Dam to the Massachusetts-N.H. state line - Although nutrient levels meet Class B standards, phosphorus concentrations are high enough to promote the growth of algae throughout this segment. Periodic coliform bacteria violations occur as the result of upstream non-point sources and urban runoff from East Pepperell.

Segment 4 - Fitchburg Westerly WWTP to Daniel Street - Dissolved oxygen depletion and periodic coliform bacteria violations at the lower end of this segment are due to the Westerly Treatment Plant discharge, as well as urban runoff and combined sewer overflows. These violations prevent this segment from meeting Class C standards.

Segment 5 - Daniel Street to the Fitchburg Easterly WWTP - This segment of the river flows through the center of Fitchburg and receives large volumes of water from storm drains and combined sewer overflows. As a result, extreme coliform bacteria problems and moderate levels of ammonia and phosphorus occur throughout the segment. Dissolved oxygen concentrations begin to recover in this segment, but coliform and nutrient levels prevent it from meeting Class C standards.

Segment 6 - Fitchburg Easterly WWTP to the Leominster WWTP - This segment does not meet standards for a Class C water. High coliform bacteria levels are the result of upstream contamination in Fitchburg and some urban runoff in the Town of Leominster. Ammonia and phosphorus concentrations are high enough to promote eutrophication throughout this segment.

Segment 7 - Leominster WWTP to the confluence with the South Nashua River - This segment is subject to periodic coliform bacteria violations as a result of upstream contamination and agricultural runoff. In addition, the Leominster Wastewater Treatment Plant discharges an effluent containing large amounts of ammonia and phosphorus. These factors, combined with a biochemical oxygen demand from the Leominster WWTP, render the water quality in this segment unsatisfactory.

Segment 8 - Outlet of Lancaster Millpond to the MDC - Clinton WWTP - High levels of nutrients and coliform bacteria from stormwater runoff in Clinton combined with the low flow resulting from limited release of water from Wachusett Reservoir cause the major water quality problems in this segment.

Segment 9 - MDC - Clinton WWTP to the confluence with the North Nashua River - The major water quality problems in this segment are caused by the effluent discharged from the Clinton WWTP. Very high levels of nutrients and coliform bacteria combine to prevent this segment from meeting its Class B designation.

Segment 10 - Flag Brook to the confluence with the Whitman River - Leachate from a landfill located on the upper end of this segment exerts a strong biochemical oxygen demand on the brook above Saw Mill Pond. Consequent low dissolved oxygen concentrations violate the standards set for Class B water. High levels of ammonia and phosphorus contribute to and algae an aquatic macrophyte problem in Saw Mill Pond. Below this pond, the brook meets Class B criteria.

Segment 11 - Whitman River to the confluence with Flag Brook - Moderate coliform bacteria levels from non-point sources,such as urban runoff in South Ashburnham,prevent this segment from meeting Class B standards.

Segment 12 - Phillips Brook - While nutrient levels are low in this brook, moderate coliform bacteria violations occur as a result of agricultural and urban runoff in Ashburnham. Higher coliform levels are found just above the confluence with the North Nashua River. This is due to runoff and combined sewer overflows in Fitchburg.

Segment 13 - Baker Brook - Urban stormwater runoff and combined sewer overflows occur in this segment. As a result, ammonia and coliform standards for Class B waters are violated.

Segment 14 - Monoosnoc Brook - Urban runoff and combined sewers in downtown Leominster contribute to coliform violations in that portion of Monoosnoc Brook. The remainder of the brook meets Class B standards.

Segment 15 - Fall Brook - With the exception of some coliform problems due to runoff from roads and parking lots in the Doyle Industrial complex, the water quality of this brook meets Class B standards.

Segment 16 - Counterpane Brook - Most of this segment flows under downtown Clinton and, therefore, receives large amounts of stormwater runoff from streets and parking lots. As a result of this urban runoff, coliform bacteria levels established for Class B waters are exceeded in this segment.

Segment 17 - Still River - Low dissolved oxygen concentrations occur in this river as a result of its sluggish flow through wetlands. Since this oxygen depletion is a natural phenomenon, it is not a violation of standards, and thus this segment meets Class B criteria.

Segment 18 - Catacoonamug Brook - The water in this segment meets all standards set for a Class B stream. Lake Shirley contributes small amounts of algae to the brook.

Segment 19 - Nonacoicus Brook - There are no major water quality problems in this Class B segment. Occasional urban runoff may occur in Harvard and Ayer.

Segment 20 - Squannacook River to Hollingsworth and Vose effluent discharge in West Groton - Periodic coliform bacteria violations throughout this segment, resulting from septic tank leachate in Townsend, prevent the river from meeting Class B standards.

Segment 21 - Squannacook River from West Groton to the Nashua River - Treated effluent discharges from two paper manufacturing plants in West Groton contribute large amounts of phosphorus to this segment. As a result, algae levels are sometimes high at the lower end of the Squannacook River. Coliform violations often occur due to stormwater runoff from West Groton and the roads and parking facilities of the two paper company complexes.

Segment 22 - James Brook - Severe dissolved oxygen depletion in this segment results from sluggish flow through wetlands and septic discharges in the Town of Groton. Although oxygen concentrations increase downstream, nutrient and coliform bacteria levels are high, due to contributions from the wetlands and non-point sources. Low dissolved oxygen and a combination of agricultural and urban runoff render the water quality in this brook unsatisfactory.

Segment 23 - Nissitissit River from the Mass.-N.H. state line to its confluence with the Nashua River - This river is often referred to as one of the cleanest segments in the Commonwealth. Present conditions meet the standards for a Class B waterbody.

TABLE 17

NASHUA RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Nashua River	From confluence of the North and South Branches, Lancaster, to the Ice House Dam	36.45-26.10	10.35	U	B1
2	Nashua River	From the Ice House Dam to Pepperell Dam	26.10-14.15	11.95	U	B1
3	Nashua River	From Pepperell Dam to Mass.-N.H. state line	14.15-10.52	3.63	U	B1
4	North Nashua	From the Fitchburg Westerly STP to Daniel Street Bridge, Fitchburg	56.14-54.04	2.10	U	C
5	North Nashua	From Daniel Street Bridge to the Fitchburg Easterly STP	54.04-48.53	5.51	U	C
6	North Nashua	From Fitchburg Easterly STP to the Leominster STP	48.53-46.42	2.11	U	C
7	North Nashua	From Leominster STP to the confluence with the South Nashua in Lancaster	46.42-36.45	9.97	U	C
8	South Nashua	From the outlet of Lancaster Millpond, Clinton, to the Clinton STP	4.60-1.57	3.03	U	B
9	South Nashua	From the Clinton STP to the confluence with the North Nashua in Lancaster	1.57-0.00	1.57	U	B1
10	Flagg Brook	From the outlet of Sawmill Pond to the confluence with the Whitman River	1.20-0.0	1.20	U	B
11	Whitman River	From the outlet of Lake Wampanoag to the confluence with Flagg Brook	6.71-0.0	6.71	C	B
12	Phillips Brook	Entire length	8.0-0.0	8.0	C	B

TABLE 17 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
13	Baker Brook	Entire Length	2.33-0.0	2.33	B	B
14	Monoosnoc Brook	Entire Length	5.67-0.0	5.67	U	B
15	Fall Brook	Entire Length	3.03-0.0	3.03	C	B
16	Counterpane Rook	Entire Length	1.14-0.0	1.14	C	B
17	Still River	Entire Length	3.1-0.0	3.10	B	B
18	Catcoonamug Brook	Entire Length	2.04-0.0	2.04	C	B
19	Nonacoicus Brook	Entire Length	1.52-0.0	1.52	C	B
20	Squannacook River	From its source in Townsend to Hollingsworth and Vose, West Groton	14.33-3.57	10.76	C	B
21	Squannacook River	From Hollingsworth and Vose to its confluence with the Nashua River, Ayer	3.57-0.0	3.57	C	B1
22	James Brook	Entire Length	4.42-0.0	4.42	C	B
23	Nissitissit River	From the N.H.-Mass. border to its confluence with the Nashua River,Pepperell	4.50-0.0	4.50	B	B

Total Miles of Class B - 9.93

Total Miles of Class C - 41.19

Total Miles of Unsatisfactory Conditions - 57.09

LAKES AND PONDS

During the summer of 1977 the Division of Water Pollution Control conducted baseline water quality surveys on 16 of the 161 lakes and ponds in the Nashua River Basin. The results of these studies will be published shortly in a report entitled Baseline Water Quality Studies of Selected Lakes and Ponds - The Nashua River Basin.

In 1976 the Division of Water Pollution Control conducted a cursory water quality survey on Bare Hill Pond in Harvard. Results of this study are available at the Division's office in Westborough.

Inventory

Nashua River Basin

Number of Lakes and Ponds	161
Surface area of Lakes and Ponds (acres)	10,933
Number of Lakes and Ponds greater than 10 acres	94
Surface area of Lakes and Ponds greater than 10 acres	10,631
Number of officially recognized Great Ponds	10
Surface area of officially recognized Great Ponds (acres)	1,094

Classification

Name		Severity Points	Stratified/ Unstratified
Wyman Pond	Westminster	12	S
Lake Shirley	Lunenburg/Shirley	11	S
Bare Hill Bond	Harvard	10	S
Sandy Pond	Ayer	10	S
Fort Pond	Lancaster	9	S
East South Meadow Pond	Clinton	9	S
Mossy Pond	Clinton	8	S
Baddacook Pond	Groton	7	S
West Waushacum Pond	Sterling	7	S
Knops Pond	Groton	6	S
Spectacle Pond	Lancaster	4	S
Lake Whalom	Leominster/Lunenburg	3	S
West South Meadow Pond	Clinton/Lancaster	9	U
Rockwell Pond	Leominster	8	U
Eagle Lake	Holden	6	U
Chaffin Pond	Holden	5	U
East Waushacum Pond	Sterling	1	U

XVIII - NORTH COASTAL DRAINAGE

The North Coastal drainage area extends from the Essex River to Boston Harbor. The thirteen cities and towns in the area range from highly urbanized Lynn, Salem, and Beverly to rural Manchester and Essex. The total area and population of the area are 137.9 square miles and 313,114 (1970) people, respectively.

Freshwater resources of the area are limited. The largest river is the Essex, and smaller tidal rivers enter each of the larger harbors--Lynn, Salem, and Beverly. Groundwater is also relatively scarce because of the nearness of crystalline igneous and metomorphic bedrock to the surface. The bedrock, which outcrops extensively along the shore, is the dominant physical aspect of this coastal area.

The major water resource in the area is saline. The harbors and bays support recreational, commercial, and industrial uses. Fishing, boating, swimming, and power generation are some of the activities.

Water Quality Surveys

From a water quality perspective, shellfishing is the most sensitive activity in the coastal area because of the stringent requirements necessary to prevent contamination of the clams and other bivalves harvested for human consumption. Except for areas in Essex and the Annisquam River, all shellfish areas are closed to harvesting because of bacterial contamination and/or the potential for the discharge of untreated sewage to these areas. A summary of the present status indicates that, of the total productive acreage in the North Shore area (3,056), 70% is closed, 11% is restricted, and 19% is open. Restricted areas can be harvested by licensed Master Diggers. Shellfish from such mildly polluted areas are sent to the depuration plant in Newburyport. At this plant, clean water is passed over the clams, allowing them to naturally cleanse themselves to the point that they are suitable for marketing. Both the plant and the license program are under the jurisdiction of the Massachusetts Division of Marine Fisheries.

The failure to meet assigned criteria is due mainly to bacterial contamination and/or small but untreated discharges of sewage. However, in recent years, an alga toxic to man has plagued the shellfish (bivalve species such as clams) in areas north of Cape Ann. Although the algae are normally present at low concentrations, they become a problem only when blooms--rapid and large increases in concentration--occur. The cause, or causes, of such blooms is not understood. Much research is now being done on both the natural and possibly man-related factors that trigger "red tide" blooms.

Segmentation

To quantify the water quality problems in each area so that they may be compared, the area is first segmented. Segmentation is the delineation of the waterbody being addressed into portions which facilitate the analysis. Major geographic features such as harbors and bays constitute segments which have been denoted numerically and are described in Table 18. In general, a segment represents a portion of the whole waterbody which is or would be affected by a discharge in the area. Areas between segments are designated by the bounding segments. Hence, the area between Gloucester Harbor(Segment 16) and Manchester Harbor (Segment 17) is designated by Segment 16-17.

Present Conditions

Segment 12 - Essex River - Presently there are 34 acres of shellfish areas closed in this segment and 300 acres of open shellfish areas. This represents the largest area of open shellfishing in the drainage basin. The segment does not meet

its assigned SA classification due to a high coliform concentration in some portions of the river. The coliform bacteria problems are not expected to be resolved in the near future, primarily because the major source of the problem is septic tank leachate; and some minor sources are vessel discharge and landfill leachate. Shellfish areas are susceptible to contamination by intermittent discharges.

Segment 13 - Essex Bay - This segment is the only one in the entire drainage area which is meeting its assigned classification.

Segment 14 - Annisquam River - This segment is presently blessed with the second-best quality of water in the drainage area. A moderate coliform problem prevents this segment from meeting its classification. The source of the problem is individual discharges and some minor runoff/vessel discharges. Therefore, it seems highly unlikely that the problem will be eliminated in the near future. Some sources of untreated discharges from the sanitary and storm sewer systems of the Town of Gloucester are in the planning stages for removal. Also, some industrial discharges are slated for removal. Presently there are 250 acres of open shellfish area (the second largest open area in the North Coastal drainage area), but because of the previously mentioned coliform problems, there are 124 acres of restricted shellfish areas and 93 acres of closed shellfish areas. (This total comprises the second largest potential shellfish area in the North Coastal drainage area.)

Segment 15 - Sandy Bay - The smallest potential shellfish area in the North Coastal drainage is located in Rockport Harbor (13 acres). This area is presently closed to shellfishing because of a major coliform problem. The source of this problem is untreated municipal sewage from the Town of Rockport. This problem is expected to be abated with the construction of the Rockport municipal wastewater treatment plant. Once the treatment plant is in operation, it is assumed that the waters will then attain their SB classification and shellfishing will then be restricted (harvesting with depuration).

Segment 16 - Gloucester Harbor - Gloucester Harbor has 37 acres of closed shellfish area. There are no restricted or open shellfish areas in the harbor. The inner harbor is classified SC and it seems highly unlikely that there will be a need to upgrade this classification based on water use. The outer harbor is classified SB, but is presently of SC quality. The problems are high coliform-related, caused by untreated main municipal discharge, combined sewer overflows, and individual and vessel discharges. The major problems will be resolved with the construction of a municipal wastewater treatment plant. The minor problems may be around for a while.

Outside of Gloucester Harbor, the area around Good Harbor Beach is fed by streams with major coliform problems. These streams in this particular area require further study to determine the sources and the solutions.

The Magnolia area also has major coliform problems, which should be resolved with the construction of a proposed Manchester-Magnolia plant.

Segment 17 - Manchester Harbor - Manchester Harbor presently has 29 acres of closed shellfish area. There are no open or restricted areas. The harbor is presently experiencing minor coliform problems emanating primarily from the small streams entering the harbor. The major sources are individual discharges; and the minor sources are runoff and vessel discharge.

Segment 18 - Beverly Harbor - Beverly Harbor includes the areas of Collins Cove, Mackerel Cove, the Danvers River, the North River and Bass River. There are 847 acres of closed shellfish area in this segment. There are no restricted or open shellfish areas. The segment has major coliform problems caused primarily by the

discharge of untreated S.E.S.D. wastewater.

Segment 19 - Salem Harbor - Cat Cove and Derby Wharf are included in this segment. There are presently 56 acres of closed shellfish area, and 55 acres of restricted shellfish area; there are no open shellfish areas in this segment. Major coliform problems are caused by the discharge of untreated wastewater from the S.E.S.D. outfalls.

Segment 20 - Salem-Beverly Harbor - Untreated S.E.S.D. wastewater discharges prevent this area from meeting its assigned SA classification. There is also a minor metals problem in this segment.

Segment 21 - Marblehead Harbor - There are presently 80 acres of closed shellfish area, 9 acres of restricted shellfish area, and 30 acres of open shellfish area in this segment. Again, the major problem is the high coliform count from the untreated S.E.S.D. wastewater discharge.

Segment 22 - Nahant Bay - Moderate coliform problems caused primarily by individual discharges and some combined sewer overflow prevent this segment from meeting its assigned SA classification. There are presently 30 acres of closed shellfish area in this segment.

Segment 23 - Saugus River - There are presently 72 acres of closed shellfish area in this segment, caused by moderate coliform problems which are attributable to all non-point sources (septage problems, landfill leachate and erosion).

Segment 24 - Pines River - There are presently 112 acres of restricted shellfish area in this segment. Moderate coliform problems emanating from combined sewer overflows and non-point sources prevent this segment from meeting its assigned SB classification.

Segment 25 - Lynn Harbor - There are presently 350 acres of closed shellfish areas in this segment, giving it the distinction of being the hardest hit in the area, just edging out Beverly Harbor. There is some optimism for the potentiality of this segment in the fact that there are 35 acres of restricted area.

TABLE 18

NORTH COASTAL DRAINAGE AREA

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	DESCRIPTION	PRESENT CONDITION	CLASSIFICATION
12	Essex River	SC	SA
13	Essex Bay	SA	SA
14	Annisquam River	SB	SA
15	Sandy Bay	SB	SA
16	Gloucester Harbor - inner	SC	SC
	- outer	SC	SB
17	Manchester Harbor	SB	SB
18	Beverly Harbor	SC	SB
19	Salem Harbor	SC	SB
20	Salem/Beverly Harbor	SC	SA
21	Marblehead Harbor	SC	SB
22	Nahant Bay	SB	SA
23	Saugus River	SC	SB
24	Pines River	SC	SB
25	Lynn Harbor	SC	SB

Segments meeting Class SA - 1
Segments meeting Class SB - 4
Segments meeting Class SC - 10

LAKES AND PONDS

Inventory

North Coastal

Number of Lakes and Ponds	85
Surface area of Lakes and Ponds (acres)	2,403
Number of Lakes and Ponds greater than 10 acres	39
Surface area of Lakes and Ponds greater than 10 acres	2,152
Number of officially recognized Great Ponds	8
Surface area of officially recognized Great Ponds (acres)	718

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Pillings Pond	Lynnfield	13	U

XIX - NORTH RIVER BASIN

The North River has the physical characteristics of two separate rivers--one portion composed of freshwater and the other saline and subject to tidal influence. To anyone not familiar with the area or the river, using the name North River to describe this stream is really quite confusing, for the stream actually bears four different names at four different locations. It would seem that those responsible for naming the river had more names available than rivers to use them on. The mainstem rivers flow approximately 21 miles through the towns of Weymouth, Pembroke, Norwell, Scituate and Marshfield discharging to Cape Cod Bay.

The headwaters of the river have its origin in the South Weymouth area, and here the river is known as French Stream. As the river flows southeasterly through Abington and Rockland, it increases in size and is joined (confluenced) by a tributary called the Drinkwater River. This enlarged stream flows into Forge Pond and upon exiting Forge Pond, becomes the Drinkwater River.

The title remains with the stream as it flows southerly through Factory Pond. When it leaves Factory Pond it picks up a new title, Indian Head River. The stream remains as Indian Head River until it reaches Curtis Crossing Dam in Hanover. The Curtis Crossing Dam is the end point of the freshwater portion. Below Curtis Crossing, the stream, now known as the North River, is a tidal stream meandering through salt marshes.

A multitude of brooks join the North River in the marshes, the largest tributary being the South River, which flows northeast from Duxbury to Marshfield. Originally, the North River turned abruptly south at Scituate and followed the present course of the South River for three miles, separated from the ocean by the narrow Humarock Beach; it then turned east and entered the ocean. During a storm in 1897, the river burst through the beach rather than turning south, forming a new mouth and closing the original one.

Seven towns have substantial portions of their areas in the North River Basin: Rockland, Hanover, Norwell, Scituate, Hanson, Pembroke, and Marshfield. Duxbury and Abington have small portions in the watershed, while Weymouth contributes an extremely small area to the basin.

The total drainage area of the basin covers 105.4 square miles and has a population of approximately 77,000.

Water Quality Surveys

Water quality surveys were conducted in 1971, 1975 and 1977. The results of these surveys are summarized in the Division's reports entitled Data Record on Water Quality, published in 1971, 1976 and 1977.

Major waste discharges were last sampled in 1977 as part of the Compliance Monitoring Program and the results are summarized in the report entitled North River, French Stream Portion, Part A & B, Data Record on Water Quality and Wastewater Discharge Data 1977.

Segmentation

The streams of the North River are divided into 15 segments. Segments 1-12 represent the freshwater portions of the stream; and segments 13-14 represent the saline portion of the stream. Segment 15, the South River, is the largest tributary in the basin. Following is a description of each segment and its water quality classification.

Present Conditions

Segment 1 - Weymouth Naval Air Station to North Abington WWTP - This segment has minor coliform and turbidity problems (groundwater runoff, settled sludge), preventing the segment from meeting its assigned B classification. Due to the fact that these problems are associated with non-point sources and settled sludge from the recently removed Weymouth Naval Air Station Wastewater Treatment Facility, it is expected that the segment will meet its assigned B classification in the near future, primarily through its self-cleansing processes.

Segment 2 - North Abington WWTP to Summer St. in Rockland - Minor coliform, dissolved oxygen, and nutrient problems along with moderate solids problems prevent this segment from meeting its assigned B classification. These problems are associated with the seepage from the North Abington STP sand filter beds.

Segment 3 - Summer Street Bridge to Rockland WWTP - There are moderate coliform, dissolved oxygen, and metals problems and minor nutrient problems. The dissolved oxygen and coliform problems are related to the marshy area through which the river is passing. The source of the metals in not known at this time.

Segment 4 - Rockland WWTP to confluence with Drinkwater River - Severe coliform, dissolved oxygen, and nutrient problems along with moderate metals and solids problems prevent this segment from meeting its assigned B classification. These conditions are due to the discharge from the Rockland Wastewater Treatment Facility.

Segment 5 - Confluence with French Stream to inlet Forge Pond - Minor coliform problems prevent this segment from meeting its assigned B classification. The dilution of the Class B waters upstream in the Drinkwater River with the Class C waters of French Stream is a major factor in the improved water quality at this point.

Segment 6 - Inlet to Outlet Forge Pond - This segment is also affected by the Rockland discharge. Dissolved oxygen and nutrient problems and metals problems are present. It does not meet its B classification.

Segment 7- Outlet Forge Pond to Fireworks Diversion - This segment is also affected by the Rockland discharge. There is some improvement in the nutrient and coliform problems, but the D.O. remains at an extremely low level, preventing this segment from meeting its assigned B classification.

Segment 8 - Fireworks Diversion to inlet Factory Pond - This segment has the capabilities for improvement (rapids, and undeveloped area), but the introduction of pollution problems (sources not defined as of this data) such as high coliform counts, COD, and solids as well as low DO from the waters of the Fireworks Diversion; combined with the initial low DO from

the upstream segment prevent this segment from meeting its assigned B classification.

Segment 9 - Inlet Factory Pond to outlet Factory Pond - This shallow pond acts as a settling basin. While the coliforms and nutrients are reduced, the DO reaches an extreme low; therefore, unless the quality of the waters upstream are improved, this segment may never attain its assigned B classification.

Segment 10 - Outlet Factory Pond to Indian Head Brook - Low D.O. from the upstream segment is the only factor preventing this segment from meeting its assigned B classification.

Segment 11 - Indian Head Brook to South Hanover Dam - Indian Head Brook is a source of moderate coliform and COD problems, minor S.S. and BOD problems; combined with the low DO problems from the upstream segment, prevent this segment from attaining its assigned B classification.

Segment 12 - South Hanover Dam to Curtis Crossing Dam - Moderate dissolved oxygen problems along with minor nutrient and metals problems exist in this segment. This is due to swampy areas and some non-point sources. Like all the previous segments, this segment is below its assigned B classification.

Segment 13 - Curtis Crossing Dam to Washington St. - This segment essentially meets its assigned SB classification. Occasional high coliform counts are due to runoff from Hanover. This segment is tidally influenced, chiefly causing a backup of fresh water during high tide.

Segment 14 - Washington St. to Massachusetts Bay - This segment essentially meets its assigned SA classification. There are occasional high coliform counts in the main stem and several of the tributaries due mainly to non-point sources. There is extensive pleasure boating in this area and the effects of this deserve further investigation.

Segment 15 - South River - Moderate coliform bacteria and minor nutrient problems are present in the South River. These problems are related to failing septic systems in the Humarock section of Scituate. The quality of the water is presently meeting the assigned SB criteria.

TABLE 19

NORTH RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	French Stream	Weymouth Naval Air Station to North Abington WWTP	25.0-21.3	3.7	C	B
2	French Stream	North Abington WWTP to Summer St. Bridge	21.3-19.4	1.9	C	B
3	French Stream	From Summer St. Bridge to Rockland WWTP	19.4-18.3	1.1	C	B
4	French Stream	From Rockland WWTP to confluence with Drinkwater River	18.3-17.4	1.9	C	B
5	Drinkwater River	From confluence with French Stream to inlet Forge Pond	17.4-17.3	0.1	C	B
6	Drinkwater River	From inlet Forge Pond to outlet Forge Pond	17.3-17.0	0.3	C	B
7	Drinkwater River	From outlet Forge Pond to Fireworks Diversion	17.0-16.6	0.4	C	B
8	Drinkwater River	From Fireworks Diversion of inlet Factory Pond	16.6-16.3	0.3	C	B
9	Drinkwater River	From inlet Factory Pond to outlet Factory Pond	16.3-15.6	0.8	C	B
10	Indian Head River	From outlet Factory Pond to Indian Head Brook	15.6-14.8	0.8	C	B
11	Indian Head River	From Indian Head Brook to South Hanover Dam	14.8-14.3	0.5	C	B
12	Indian Head River	From South Hanover Dam to Curtis Crossing Dam	14.3-12.7	1.6	C	B
13	North River	From Curtis Crossing Dam to Washington St.	12.7-10.9	1.8	SB	SB
14	North River	From Washington St. to Mass. Bay	10.9-0.0	10.9	SA	SA
15	South River	From Headwaters to North River	10.6-0.0	10.6	SA	SB

Total Miles Class C - 9.3
Total Miles Class SA - 10.9
Total Miles Class SB - 1.8

LAKES AND PONDS

There are 57 lakes and ponds in the North River Basin. Baseline water quality surveys have been performed on two of these--Factory Pond and Forge Pond. These data are available at the Westborough office.

Inventory

North River Basin

Number of Lakes and Ponds	57
Surface area of Lakes and Ponds (in acres)	1,557
Number of Lakes and Ponds greater than 10 acres	30
Surface area of Lakes and Ponds greater than 10 acres	1,417
Number of officially recognized Great Ponds	7
Surface area of officially recognized Great Ponds (in acres)	749

Classification

Name	Location	Severity Points	Stratified/ Unstratified
Factory Pond	Hanover/Hanson	16	S
Forge Pond	Hanover	16	U

XX - SOUTH COASTAL DRAINAGE AREA

The South Coastal drainage area is located southeast of Boston includes the towns of Kingston, Plymouth, and Plympton, and is specifically concerned with the waters of these towns which drain to Cape Cod Bay. Other communities partially in the South Coastal drainage area are being considered in either the North River area, Taunton River Basin, or Buzzards Bay area.

The waters of the drainage area are of generally good quality. Poor quality water does exist in isolated areas in the area. Failing septic systems and an industrial discharge in Kingston prevent the lower portion of the Jones River from meeting Class SA quality. The discharge from the Plymouth wastewater treatment facility and combined sewer overflows in Plymouth prevent Plymouth Harbor from meeting Class SA quality.

The coastal waters are subject to a large variety of recreational uses including fishing, boating, swimming, and aesthetic enjoyment. The water quality problems outlined in the above paragraph have resulted in the closing of substantial acreage to shellfishing.

The communities of the South Shore drainage area are generally residential and resort communities. These communities, particularly Plymouth, derive a large portion of their economic base from the retail and tourist-related industries. Attractions such as Plymouth Rock, the Mayflower, and Plimouth Plantation are responsible for a large summer influx of people. These same communities are also subject to large increases in population as people move to their summer residences. This summer influx can have an adverse effect on the water quality of the area.

Water Quality Surveys

In the summer of 1974, the Division conducted a water quality survey of Plymouth Harbor. Five locations at and around the Plymouth wastewater treatment facility outfall were sampled on high and low tides. Water quality information on other portions of the area was extracted from the sampling records of the Massachusetts Department of Public Health.

In order to express the varying degrees of pollution in the basin, the waters of the South Coastal drainage area have been subdivided into six segments identified in Table 15.

Present Conditions

Segment 0 - Jones River above Wapping Road, Kingston - The upper reaches of Jones River are classified as B waters. Minor coliform problems stemming from a failing subsurface disposal system at Silver Lake Regional High School prevent this segment from meeting its assigned classification.

Segment 1 - Jones River from Wapping Road to Elm Street - This segment has minor solids and dissolved oxygen problems. These problems are caused by the discharge from Barnes Worsted and prevent the segment from meeting its B classification.

Segment 2 - Jones River Estuary - This segment has severe coliform problems and is closed to shellfishing. Approximately 67 acres of shellfish area are presently closed. The problems are caused by individual raw wastewater discharges. This segment does not meet its assigned SA classification.

Segment 3 - Kingston Bay - The bay is presently meeting its assigned SA classification. There are several localized problem areas, but the large volume of water in the bay supplies ample dilution. The water quality is below SA in the local problem areas.

Segment 4 - Plymouth Harbor - The harbor has moderate coliform problems, particularly in the area of the Plymouth wastewater treatment facility outfall. Combined sewer overflows and extensive pleasure boating also add to this problem. The result is 280 acres of shellfish area remaining closed. The overall quality of the harbor is SB with areas, particularly those near the shoreline and combined sewer overflows, being SC. The harbor is, therefore, not meeting its assigned SA classification.

Segment 5 - Plymouth Bay - Plymouth Bay is presently meeting its assigned SA classification. The area near the thermal discharge from the Pilgrim nuclear power plant is presently undergoing intense study by private consultants in an effort to assure that SA quality water is maintained.

TABLE 20

SOUTH COASTAL DRAINAGE AREA

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
0	Jones River	Kingston, Plymton	Above 3.4	3.4	C	B
1	Jones River	Kingston	3.4-2.5	0.9	C	B
2	Jones River Estuary	Kingston	2.5-0.0	2.5	SC	SA
3	Kingston Bay	Kingston	---	---	SA	SA
4	Plymouth Harbor	Plymouth	---	---	SB	SA
5	Plymouth Bay	Plymouth	---	---	SA	SA

All waters not otherwise noted are classified SA

Segments meeting Class C - 2
Segments meeting Class SA - 2
Segments meeting Class SB - 1
Segments meeting Class SC - 1

LAKES AND PONDS

Inventory

South Coastal Drainage Area

Number of Lakes and Ponds	116
Surface Area of Lakes and Ponds (acres)	3,402
Number of Lakes and Ponds Greater than 10 acres	56
Surface Area of Lakes and Ponds greater than 10 acres (acres)	3,097
Number of officially recognized Great Ponds	7
Surface area of officially recognized Great Ponds (acres)	862

Classification

No lakes or ponds have been classified.

XXI - SUASCO RIVER BASIN

Located in east-central Massachusetts, the SUASCO River Basin is comprised of the Assabet and Sudbury rivers which flow together to form the historic Concord River. The three rivers represent quite a contrast in waterbodies, each having its own unique physical characteristics and its own water quality problems.

The Assabet River has its beginning in the Town of Westborough and flows northeast through the urban centers of Northborough, Hudson, Maynard, and Concord. The river is characterized by the following repeating sequence: a sewage treatment plant effluent discharging into the headwaters of an impoundment. The impoundments are highly eutrophic with large amounts of aquatic growth, especially algal blooms during certain periods of the summer. The river is 31 miles long and has a drainage area of 175 square miles. The basin is urban along most of the Assabet's course, and rural in the outlying areas of the basin.

The Sudbury River also has its beginning in the Town of Westborough, flowing from Cedar Swamp eastward to Framingham, then north through the towns of Sudbury, Wayland, Lincoln, and into the Town of Concord. The Sudbury River is characterized by three distinct physical sections. Upstream of Framingham, the river is a narrow, rapidly-flowing stream dotted with a few small impoundments. In Framingham, the river has two large impoundments: the first is part of the Metropolitan District Commission water supply, and the second is created by the Colonna Dam in Saxonville. The third and unique section of the river is that which flows through the National Wildlife Refuge meadowlands in the towns of Sudbury, Wayland, Lincoln, and Concord. Through this area (river distance of 12 miles), the river's elevation changes only <u>one</u> foot and the river is akin to an elongated lake.

The Sudbury River is 41 miles long with a drainage area of 160 square miles, 29 of which drain to the MDC reservoirs. This area is rapidly being urbanized with tremendous population growth rates in many of the towns within the basin.

The Concord River flows north through the towns of Concord, Carlisle, Bedford, Billerica, and the City of Lowell where it flows into the Merrimack River. The Concord River retains the slow-moving characteristic of the Sudbury River as it flows north through the Great Meadows Wildlife Refuge Area. From the Talbot Dam in Billerica, the river is an urban river, receiving industrial and municipal discharges and raw sewage discharges from the sewers and canals in the City of Lowell.

The Concord River is 15.8 miles long and drains 62 square miles, for a combined total (including the Assabet and Sudbury rivers) of 406 square miles. The Concord River Basin has two main urban centers in the Lowell and Concord areas, and some rural areas such as those still found in Carlisle. The Concord area is steeped in history and culture. For example, the "shot heard round the world" was fired at the North Bridge in Concord. The transcendental literary geniuses, such as Thoreau, Emerson, and Whitman, resided in the area.

Water Quality Surveys

In the summer of 1973, the Division of Water Pollution Control conducted an intensive water quality survey of the Concord and Sudbury rivers. During the weeks of July 9-13 and August 28-31, samples were taken every six hours for a continuous 72-hour period. Five locations on the Concord River, nine on the Sudbury River, four on Hop Brook, and two on major tributaries were sampled both weeks. The results of this survey are published by the Division in the report entitled The Concord and Sudbury Rivers 1973, Part A.

During the weeks of June 4-8 and September 19-23, 1974, the Assabet River was intensively surveyed by the Division. Samples were taken every four hours for a continuous 72-hour period at nineteen locations on the mainstem of the Assabet River and at five locations on major tributaries. The results of this survey were published by the Division in the report entitled The Assabet River 1974, Part A.

The data obtained from the various surveys were analyzed in the following reports: The Concord and Sudbury Rivers 1973, Part C and The Assabet River 1974, Part C, published by the Division. These reports include an analysis of the data from the stream surveys complemented with discussions of the basin's history, the wastewater discharges, water uses, planning programs, and areas of future study.

The Division, as part of its continuing water quality monitoring program, is scheduled to resurvey the SUASCO River Basin the summer of 1979.

During the week of August 29-September 1, 1977, the Division of Water Pollution Control conducted a survey of the major wastewater discharges in the SUASCO River Basin. The survey was conducted in accordance with regulations promulgated by the United States Environmental Protection Agency. The results of the survey were published by the Division in the report entitled The SUASCO River Basin, 1977, Part B.

Segmentation

The SUASCO River Basin includes the Assabet, Sudbury, and Concord rivers. These rivers are divided into segments according to wastewater discharge locations or significant changes in water quality and stream hydraulics. Table 21 presents these segments along with their water use classifications and existing water quality conditions. Also included is Hop Brook, a major tributary to the Sudbury River. The revised Massachusetts Water Quality Standards propose that the Sudbury, Assabet, and Concord rivers and Hop Brook be assigned B water use classifications. These updated standards are currently under review and will be finalized at a later date.

Present Conditions

Segment SU01 - Headwaters to the outlet of Saxonville Pond - This segment has periodic coliform bacteria violations in the heavily populated areas of Ashland and Framingham. The major sources of this bacteria are urban runoff, septic leachate, and storm sewer overflows.

Segment SU02 - The outlet of Saxonville Pond to Wash Brook - Dissolved oxygen levels in this segment are extremely low during the time of year when oxygen depleted water from the adjoining meadowlands overflow into the main channel of the river. Since this oxygen depletion is considered to be a naturally occurring phenomenon, it is not in violation of the water quality standards. However, high nutrient levels originating in upstream wetlands and coliform bacteria problems, due to upstream and local urban runoff, prevent this segment from meeting the standards for a B classification.

Segment SU03 - Wash Brook to the Confluence with the Assabet River - This segment shows a continuation of the periodic coliform bacteria violations and low dissolved oxygen levels from upstream and adjacent wetlands.

Segment HP01 - Hop Brook from Marlborough East STP to the Sudbury River - The Marlborough East Tertiary Sewage Treatment Plant utilizes the activated sludge process, nitrification, and phosphorus removal. The upper portion of Hop Brook is a series of four eutrophic millponds which exhibit severe algae blooms during the spring and summer months. Following this series of millponds, the shallow middle reach of Hop Brook flows rapidly along, carrying large amounts of algae and nutrients. In addition, periodic coliform bacteria violations occur. In the lower portion of Hop Brook, diurnal dissolved oxygen variation reflects the high concentrations of algae from upstream. The final 1.5 miles of Hop Brook, above the confluence with the Sudbury River, flows through wetlands and is subject to seasonal oxygen depletion. Coliform bacteria levels are high as a result of septic leachate and urban runoff in Sudbury. The combined effects of the above conditions render the water quality in this segment unsatisfactory.

Segment CO01 - From confluence of the Sudbury and Assabet Rivers to the Billerica STP - As in the Sudbury River, seasonal dissolved oxygen depletion occurs as a result of sluggish flow through meadowlands in this segment. High coliform bacteria levels result from meadowland runoff and septic leachate. Ammonia and phosphorus concentrations are high enough to promote eutrophication. This segment does not meet Class B standards.

Segment CO02 - Billerica STP to the confluence with the Merrimack River- This segment has coliform bacteria problems due to raw sewage discharges in Lowell. Nutrient levels are moderately high, as well, rendering the water quality unsatisfactory.

Segment AS01 - Headwaters to the Westborough STP - Dissolved oxygen and coliform bacteria levels in this segment are satisfactory. High ammonia, moderate phosphorus levels and consequent algal populations originate in the flow augmentation pond at the headwaters. With the exception of these high ammonia concentrations, this segment meets the standards for the B water use classification to which it is assigned.

Segment AS02 - Westborough STP to Shrewsbury STP - Low flow severely limits the assimilative capacity of the water in this short segment. Effluent from the Westborough Secondary Sewage Treatment Plant contributes very large amounts of ammonia and phosphorus. These high nutrient concentrations, combined with common coliform bacteria violations and low flow conditions, result in unsatisfactory water quality in this segment.

Segment AS03 - Shrewsbury STP to Dam, Route 20, Northborough - The poor water quality resulting from upstream discharges is further degraded by the addition of effluent from the Shrewsbury Sewage Treatment Plant. Severe oxygen depletion occurs as the biochemical oxygen demand of this effluent is exerted. Furthermore, extremely high nutrient and coliform bacteria levels result from this discharge.

Segment AS04 - Dam, Route 20, Northborough to Marlborough West STP - High nutrient levels from upstream sewage treatment plant discharges are carried along in this segment and cause eutrophic conditions in the impoundment above Allen Road. Dense growth of aquatic vegetation occurs throughout the impoundment in response to the rich nutrient loading. Although oxygen concentrations begin to recover in this segment, standards for a Class B water are violated as a result of upstream oxygen depletion and diurnal variation. Coliform bacteria levels remain high throughout the segment.

Segment AS05 - Marlborough West STP to Hudson STP - Nutrients from upstream sources cause eutrophic conditions throughout this segment. Large quantities of aquatic macrophytes cause a significant diurnal fluctuation of the dissolved oxygen levels. Moderate coliform bacteria levels are further augmented by urban runoff and sewer leakage in the Town of Hudson. The water quality of this segment does not meet Class B standards.

Segment AS06 - Hudson STP to the outlet of Boons Pond - High nutrient levels resulting from the Hudson Sewage Treatment Plant discharge cause severe eutrophic conditions in the Gleasondale impoundment. Characteristic oxygen depletion occurs in the summer months. Dissolved oxygen concentrations begin to recover in the lower portion of this segment where a diurnal fluctuation is exhibited. These conditions, combined with periodic coliform bacteria violations, prevent this segment from meeting Class B standards.

Segment AS07 - Outlet of Boons Pond to the Maynard STP - Moderate ammonia and high phosphorus levels from upstream sources promote extensive growth of aquatic vegetation in this segment. While dissolved oxygen levels improve markedly in this segment, periodic coliform bacteria problems still occur. Although this segment meets Class C standards, it does not comply with standards for its designated B classification.

Segment AS08 - Maynard STP to the Mass. Correctional Institute in Concord - High nutrient levels and periodic dissolved oxygen violations prevent this segment from meeting Class B standards. Problems result from upstream sources, as well as the effluent discharge from the Maynard Sewage Treatment Plant.

Segment AS09 - Mass. Correctional Institute in Concord to the confluence with the Sudbury River - Water quality in this segment remains unsatisfactory due to nutrient, dissolved oxygen, and regularly occurring coliform bacteria standards violations.

TABLE 21

SUASCO RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Sudbury River	Above outlet, Saxonville Pond	Above 16.4	15.0	U	B
2	Sudbury River	Outlet, Saxonville Pond to Wash Brook	16.4-11.0	5.4	U	B
3	Sudbury River	Wash Brook to confluence, Assabet River	11.0-0.0	11.0	U	B
1	Hop Brook	Marlborough East STP to Sudbury River	9.7-0.0	9.7	U	B
1	Concord River	Sudbury River to Billerica STP	15.2-4.0	11.2	C1	B
2	Concord River	Billerica STP to Merrimack River	4.0-0.0	4.0	U	C
1	Assabet River	Above Westborough STP	Above 30.4	1.4	B	B
2	Assabet River	Westborough STP to Shrewsbury STP	30.4-29.6	0.8	U	B1
3	Assabet River	Shrewsbury STP to Rte. 20 dam, Northborough	29.6-26.5	3.1	U	B1
4	Assabet River	Rte. 20 dam to Marlborough West STP	26.5-24.0	2.5	U	B
5	Assabet River	Marlborough West STP to Hudson STP	24.0-15.9	8.1	U	B
6	Assabet River	Hudson STP to outlet of Boons Pond	15.9-12.4	3.5	U	B1
7	Assabet River	Outlet, Boons Pond, to Maynard STP	12.4-6.8	5.6	C1	B
8	Assabet River	Maynard STP to Concord MCI	6.8-2.6	4.2	U	B
9	Assabet River	Concord MCI to Sudbury River	2.6-0.0	2.6	U	B

Total Miles of Class B - 1.4
Total Miles of Class C - 0.0
Total Miles of Class C1 - 16.8
Total Miles of Unsatisfactory Conditions - 69.9

LAKES AND PONDS

The SUASCO River Basin contains 121 lakes and ponds, three of which have been studied in intensive year-round water quality surveys. Waushakum Pond (Ashland/Framingham) and Nutting Lake (Billerica) were surveyed monthly for one year, while Lake Cochituate (Natick/Ashland/Framingham) is being studied over a two-year period (1976-1978). The results of these surveys were published by the Division of Water Pollution Control in a separate report for each lake.

During the summer of 1974, the Division conducted baseline water quality surveys on six of the 58 lakes and ponds in the Assabet River Basin. These studies were done on the Assabet flow augmentation pond, Boons Pond, Lake Chauncy, Warners Pond, Rocky Pond, and Hocomonco Pond,and the results were promulgated by the Division in a document entitled Baseline Water Quality Studies of Selected Lakes and Ponds - The Assabet River Basin 1974.

Inventory

	Concord & Sudbury	Assabet
Number of Lakes and Ponds	63	58
Surface Area of Lakes and Ponds (acres)	4,485	2,403
Number of Lakes and Ponds Greater then 10 acres	41	34
Surface area of Lakes and Ponds greater than 10 acres	4,373	2,273
Number of officially recognized Great Ponds	6	6
Surface area of officially recognized Great Ponds(acres)	442	353

Classification

Name	Location	Drain-age	Severity Points	Stratified/ Unstratified
Lake Cochituate (North Basin)	Framingham/Wayland	Sudbury	12	S
(South Basin)	Natick	Sudbury	11	S
(Carling Basin)	Natick	Sudbury	11	S
(Middle Basin)	Natick	Sudbury	10	S
Warner's Pond	Concord	Assabet	10	S
Waushakum Pond	Ashland/Framingham	Sudbury	9	S
Chauncy Lake	Westborough	Assabet	6	S
Boons Pond	Hudson/Stow	Assabet	4	S
Rocky Pond	Boylston	Assabet	2	S
Nutting Lake	Billerica	Concord	13	U
Flow Augmentation Pond	Westborough	Assabet	11	U
Hocomonco Pond	Westborough	Assabet	8	U

XXII - THE TAUNTON RIVER BASIN

The Taunton River with its complex of tributaries drains 530 square miles of southeastern Massachusetts, and empties into Mount Hope Bay, sub-basin of the Narragansett Bay watershed. The Taunton River is formed in Bridgewater at the confluence of the Town and Matfield rivers, and extends for approximately 38 miles before flowing into Mount Hope Bay. The primary gaging station in the basin is located at the State Farm in Bridgewater (drainage area 260 miles). The average annual discharge at this station is 475 cubic feet-per-second (cfs) based on 41 years of record. Several major tributary systems feed the mainstem of the Taunton River.

The Matfield River drains 77 square miles in the northern section of the Taunton Basin. The river originates from a number of small brooks in Stoughton, Brockton and Avon. Two major brooks, Salisbury Brook and Trout Brook, join to form the Salisbury Plain River in the center of Brockton. The Salisbury Plain River flows in a southerly direction and becomes the Matfield River in East Bridgewater at its confluence with Beaver Brook. The Matfield River and its tributaries are generally free-flowing. The Satucket River, which drains areas of Whitman, Hanson and East Bridgewater, joins the Matfield River in Bridgewater.

The Town River is fed by a number of tributary streams which originate in Stoughton and Easton. Much of the drainage area is relatively flat with large swamp and marsh lands. Coweeset Brook and Queset Brook form the Hockomock River, which flows south through the Hockomock Swamp. The outflow from Lake Nippenicket joins the Hockomock River to form the Town River. The Town River flows in an easterly direction, meandering through West Bridgewater and Bridgewater. Its last few miles are very slow-flowing, because of the backwater created by the dam at the confluence of the Town and Matfield rivers.

With the exception of the major dam in Bridgewater at its very beginning, the Taunton River flows without physical obstruction on its course toward Mount Hope Bay. The terrain is relatively level so the river is slow-moving with only a few short sections of rapids. The freshwater portion of the river maintains a fairly uniform cross-section with a width of about 80 feet. The Taunton flows southeasterly through Bridgewater and then turns toward the southest, forming the Bridgewater - Halifax and Bridgewater - Middleborough town boundaries. Along this section, the Taunton receives the flow of two fairly large tributaries, the Winnetuxet and Nemasket rivers.

The Winnetuxet River flows through a sparsely populated section of the Taunton Basin. It drains portions of Carver, Plympton, Halifax and Middleborough. The Nemasket River is formed from the outflow of a complex of large ponds in Lakeville and Middleborough. Long Pond and Great Quittacas Pond drain into Assawompset Pond. These ponds are one of the major sources of water supply for southeastern Massachusetts. From Assawompset Pond, the Nemasket River flows north on its 11-mile course to the Taunton. After passing the control dam in Middleborough, the Nemasket flows freely, but it becomes quite sluggish in its last few miles as it approaches the Taunton River.

After being joined by the Nemasket, the Taunton River continues flowing in a generally southwesterly direction and forms the boundary line between Raynham and Middleborough and then Raynham and Taunton. In East Taunton, the river becomes tidal, with tide waters from Mount Hope Bay reaching more than 18 miles upstream. In the City of Taunton, the Taunton River turns south, maintaining its relatively narrow channel-like appearance. Downstream of the

confluence with the Three Mile River, the Taunton widens into a broad tidal estuary.

The Mill River enters the estuary in Taunton. The Mill River is fed by the Canoe River and Mulberry Meadow Brook which drains portions of the towns of Mansfield, Norton, and Easton. The upstream tributaries flow into Winnecunnet Pond, then into Lake Sabbatia via the Snake River. From the outlet of Lake Sabbatia, the Mill River passes through the urban center of the City of Taunton, and then joins the Taunton River.

The Three Mile River watershed encompasses a large area in the western portion of the Taunton Basin. The two major tributaries of the Three Mile are the Rumford and Wading rivers. The Rumford River originates in Foxboro and flows in a southerly direction through Mansfield, where it is joined by Robinson Brook before flowing into Norton Reservoir, a shallow pond of 530 acres. From the outlet located on the southeastern periphery of the Reservoir, the Rumford River flows southward and is joined by the Wading River in Norton. The headwaters of the Wading River are also located in Foxboro. The Wading flows in a southerly direction, joins Charley Brook in Norton and turns eastward to meet the Rumford River.

The Three Mile River, which is formed at the confluence of the Rumford and Wading rivers, passes through Norton and into the Oakland Reservoir in Taunton. The lower two miles of the Three Mile are tidal and the river enters the Taunton Estuary at the junction of the Taunton, Dighton, and Berkley boundaries. Numerous dams located along the Three Mile and its tributaries, create many impoundments and slow-flowing sections of river.

The Assonet River is the last major tributary to empty into the Taunton Estuary. The freshwater portion of the Assonet flows through Lakeville and Freetown. The lower Assonet forms a broad estuarine finger of the Taunton River.

The Taunton Estuary enters Mount Hope Bay at a point opposite Battleship Cove in Fall River. In addition to the Taunton River, four other rivers flow into Mount Hope Bay. The Cole and Lee rivers have their headwaters in Dighton and Swansea, respectively, and enter the Bay from the North. The Kickamuit River flows in a southerly direction from Swansea and enters the northwest corner of Mount Hope Bay in Bristol, Rhode Island. The Cole, Lee, and Kickamuit rivers have relatively small drainage areas, but they develop wide estuaries at their mouths. The Quequechan River is the other river that drains into Mount Hope Bay. It originates in the Watuppa Pond and flows westerly, entering Mount Hope Bay via Battleship Cove. The Quequechan runs through the urban center of Fall River and is culverted for its last mile.

Mount Hope Bay contains a surface area of about 14 square miles. Only 30 percent of the bay is located in Massachusetts, while 70 percent is in Rhode Island. The two outlets of the bay are the East Passage of Narragansett Bay and the Sakonnet River. About 70 percent of the bay has a mean low water depth less than 18 feet. A channel with a 35 foot mean low water depth runs from the Mount Hope Bridge northeasterly to a point several miles up the Taunton River. A similar channel extends from a location between Mount Hope Point and Common Fence Point in an easterly direction toward Fall River and then runs northerly along the Fall River shoreline.

Water Quality Surveys

Detailed field surveys were conducted in 1970, 1971, and 1975 to determine existing water quality problems. The surveys indicated that violations of the Massachusetts Water Quality Standards occur throughout the basin. Most major municipal and industrial discharges are presently inadequately treated. Organic pollution loads deplete nearly all the dissolved oxygen in portions of the Matfield, Nemasket, and Taunton rivers. High levels of phosphorus and nitrogen stimulate prolific growth of algae and rooted aquatic plants in the river impoundments. Unchlorinated sewage from various outfalls causes bacteriological contamination. The discharge of chemical dyes, toxic metals and cooling water from industries in the basin further degrades the quality of the Taunton River and its tributaries. In addition to the point discharges from municipalities and industries, pollution is caused by other sources such as combined sewer overflows, stormwater runoff, dairy farming and oil.

Present Conditions

Segment 1 - Taunton River from its source to Nemasket River confluence - Problems in this segment are caused by the Brockton STP discharge, Bridgewater STP discharge, and some non-point problems. Already low dissolved oxygen concentrations steadily decrease due to nitrogenous oxygen demand. Nutrient and coliform levels remain high.

Segments 2 and 3 - Taunton River, Nemasket River to Mill River confluence - Organic loads from the upstream discharges are assimilated and dissolved oxygen recovers to normal levels. However, large amounts of phosphorus and nitrate are present in the freshwater flow.

Segment 4 - Taunton River, Mill River to Berkley Bridge - Discharges affecting this segment are the Taunton STP, Geilich Tanning, Royce Aluminum, combined sewers in Taunton, and the Harodite Finishing discharge at the confluence of the Three Mile River. Because of these discharges, the D.O. remains low and the nutrients remain high. The heavy nutrient load also causes a significant algal growth. Coliform levels remain high. Slight temperature increase occurs due to the Taunton Municipal Light Company.

Segment 5 - Taunton River, Berkley Bridge to mouth at Battleship Cove - Downstream of the Berkley Bridge, the estuary broadens and the tidal waters increase the volume of the estuary. Due to the large volume of water, D.O. increases, but remains low during low tide. Nutrient and coliform levels decrease. There is also a slight temperature increase caused by the Montaup Electric discharge. Other problems include combined sewer overflows and the Quequechan River, which receives large quantities of industrial wastes and raw sewage.

Segment 6 - Salisbury Plain and Matfield Rivers - Some urban runoff problems are noted above the Drew Tanning and Brockton STP discharges. Below these discharges, the river is severely degraded with low D.O. and high nutrient, solids, color, and coliform concentrations.

Segment 7 - Trout Brook - Urban runoff and one plating company discharge contribute to problems in this segment. Major violations occur in dissolved oxygen and coliform.

Segment 8 - Beaver Brook - Low D.O. is caused by natural conditions. Slight total coliform problems are caused by non-point problems.

Segment 9 - Satucket River and its tributaries - Problems in this segment include dissolved oxygen, coliform and a slight nutrient problem. These problems are caused by non-point sources.

Segment 10 - Town - Hockomock River - Discharges in this lower portion segment are the Bridgewater STP, Howard School to the Town River, and a process waste from a dairy discharging to South Brook. There are D.O. sags downstream of these discharges. The phosphorus and nitrogen inputs also promote algae and aquatic weed growth. Coliform results also indicate bacterial contamination.

Segment 11 - Queset Brook - There are slight-to-moderate coliform violations in the lower segment; also a slight nutrient problem. These are due to non-point problems.

Segment 12 - Coweset Brook - Moderate nutrient and slight total coliform problems are due to non-point problems.

Segment 13 - Winnetuxet River - This segment meets, or exceeds, Class B criteria.

Segment 14 - Nemasket River - The upper portion of the Nemasket River is relatively clean, although the 1975 total coliform data indicated raw sewage enters the river as it passes through Middleborough. However, these problems have been corrected in conjunction with the new treatment plant. Because of this, the water quality is greatly improved and should meet Class C criteria.

Segment 15 - Saw Mill Brook - All parameters are violated due to the discharge from the Bridgewater MCI.

Segment 16 - Poquoy Brook - High flow periods cause coliform and nutrient problems due to cranberry bogs.

Segment 17 - Cotely River - There are coliform problems during high flows due to non-point sources; all other parameters are meeting standards.

Segment 18 - Canoe- Snake River from source to Whittendon Dam - The river receives a large amount of drainage from swamps, causing naturally low D.O. and high total coliforms at times. It meets, or exceeds, other Class B criteria.

Segment 19 - Mill River from Whittendon Dam to confluence with Taunton River - Combined sewer overflows cause severe dissolved oxygen depletion and bacterial contamination.

Segment 20 - Robinson Brook from source to Rumford River - D.O., nutrient and coliform violations are due to improperly treated sewage.

Segment 21 - Rumford River, from source to outlet Norton Reservoir - Violations occur in dissolved oxygen and coliform bacteria levels upstream of Norton Reservoir, due to improperly treated sewage and non-point sources. Nutrient loads from several sources are contributing to serious eutrophication of Norton Reservoir. Nutrients enter the reservoir from the Rumford River and from Back Bay Brook, which contains the effluent from the Mansfield secondary treatment plant. Excessive algae levels cause nuisance conditions, greatly limiting the reservoir's recreational potential.

Segment 22 - Rumford River, outlet Norton Reservoir to confluence with Wading River - In the section of the Rumford River from the outlet of Norton Reservoir to its confluence with the Wading River, the effects of sludge demand from settled algae and from minimal stream reaeration cause a depletion in the D.O. levels.

Segment 23 - Wading River from source to Chartley Brook - Slight total coliform problems occur due to natural conditions and/or malfunctioning septic systems.

Segment 24 - Chartley Brook - Moderate algae growth in late summer causes D.O. variation. All other criteria are met.

Segment 25 - Wading River from Chartley Brook to Threemile River - The discharge severity degrades the quality of this segment. Severe D.O., pH and coliform problems, with moderate nutrient problems occur in this segment.

Segment 26 - Threemile River, Wading River to Taunton River - Due to high nutrient values, algal and plant growth cause a diurnal curve in the dissolved oxygen. Bacterial contamination results from the Paul Dever School STP, Lovering Colony STP, and raw sewage entering the river in North Dighton. A significant pollutional load from the Harodite Finishing plant is discharged into the tidal portion of the Threemile River.

Segment 27 - Segreganset River - Slight D.O., BOD, coliform and nutrient problems from Dighton-Rehoboth Regional School discharge affect the upper portion of this segment. Lower portions meet Class B criteria.

Segment 28 - Muddy Cove - Above ICI discharge, there are no known problems. Below the ICI discharge there are moderate D.O., color and coliform violations.

Segment 29 - Assonet River - Slight coliform violations here are due to non-point sources.

Segment 30 - Quequechan River - There is a severe violation of parameters in this segment due to improperly treated industrial wastes and raw sewage discharges.

Segment 31 and 32 - Mount Hope Bay - Mount Hope Bay is a relatively enclosed body of water with major freshwater flow entering from the Taunton estuary in the north and with two distinct outlets in the southern portion of the bay. The water quality problems that exist emanate from the municipal and industrial discharges directly into the bay and from the pollutant load carried by the Taunton River.

Heavy development in the City of Fall River is located along the eastern shoreline. The city's primary treatment plant discharges a large load of organic material and suspended solids to the Bay. The Fall River sewerage system also has many combined sewers, and 14 overflows are located along the shoreline. During periods of rain, much of the sewage overflows directly to the bay before reaching the treatment plant. Many of the industries in Fall River discharge wastewater to the Quequechan River, which flows into the bay at Battleship Cove. Two electric generating stations, Brayton Point and Montaup, discharge large amounts of cooling water into Mount Hope Bay.

The Taunton River inflow, and the discharges in the Fall River area, cause two major water quality problems. The large amounts of raw sewage discharged lower the bacteriological quality of the bay. During periods of heavy rain, the combined sewer discharges further degrade bacterial quality. All the suspended material in these discharges causes another significant problem. The solids discolor the surface waters and exert a demand on the oxygen when they settle to the bottom.

Mount Hope Bay is also enriched as a result of nutrient loads. The algae that result cause daily variations in the D.O. levels in the Bay. During the early morning hours before photosynthesis begins, algal respiration causes the D.O. level to be depleted.

The thermal discharges cause a rise in water temperature in localized areas. In both the 1970 and 1971 surveys during August, the thermal discharge from Brayton Point caused temperatures in excess of 88^{o}F at the mouth of the Lee River.

Segment 33 - Lee River - There are no known problems.

Segment 34 - Cole River - No known problems exist in this segment.

Segment 35 - Kickimuit River - There are no known problems.

TABLE 22

TAUNTON RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Taunton River	From its source to Nemasket River confluence	40.8-33.9	6.9	U	C
2	Taunton River	From Nemasket River confluence to Route 24 Bridge	33.9-21.7	12.2	U	C
3	Taunton River	From Route 24 Bridge to Mill River confluence	21.7-18.5	3.2	U	C
4	Taunton River	From Mill River confluence to Berkley Bridge	18.5-13.0	5.5	U	C
5	Taunton River	From Berkley Bridge to mouth at Battleship Cove	13.0-2.7	10.3	U	C
6	Salisbury Plain and Matfield Rivers	Entire length	53.3-40.8	12.5	U	C
7	Trout Brook	Entire length	4.0-0.0	4.0	C	C
8	Beaver Brook	Entire length	16.0-0.0	16.0	B	B
9	Satucket-Shumatuscacant River	Entire length	14.4-0.0	14.4	U	B
10	Town-Hockomock River	Entire length	11.2-0.0	11.2	B	B
11	Queset Brook	Entire length	6.5-0.0	6.5	B	B
12	Coweset Brook	Entire length	4.4-0.0	4.4	B	B
13	Winnetuxet River	Entire length	8.2-0.0	8.2	B	B
14	Nemasket River	Entire length	10.5-0.0	10.5	B	B
15	Sawmill Brook	Entire length	1.5-0.0	1.5	U	B
16	Poquoy Brook	Entire length	3.7-0.0	3.7	B	B
17	Cotely River	Entire length	4.5-0.0	4.5	B	B

TABLE 22 (CONTINUED)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
18	Canoe-Snake River	From source to Whittendon Dam	18.2-3.5	14.7	B	B
19	Mill River	From Whittendon Dam to confluence with Taunton River	3.5-0.0	3.5	U	B
20	Robinson Brook	From source to Rumford River	3.0-0.0	3.0	U	B
21	Rumford River	From source to outlet Norton Reservoir	19.4-14.7	4.7	U	B
22	Rumford River	From outlet Norton Reservoir to Wading River	14.7-11.3	3.4	U	B
23	Wading River	From source to Chartley Brook	12.2-4.5	7.7	B	B
24	Chartley Brook	Entire Length	2.5-0.0	2.5	B	B
25	Wading River	From Chartley Brook to Threemile River	4.5-0.0	4.5	U	B
26	Threemile River	From Wading River to Taunton River	11.3-0.0	11.3	U	B
27	Segreganset River	Entire length	6.5-0.0	6.5	B	B
28	Muddy Cove Brook	Entire length	3.0-0.0	3.0	SB	SB
29	Assonet River	Entire length	7.0-0.0	7.0	SB	SB
30	Quequehan River	Entire length	2.5-0.0	2.5	U	C
31	Mount Hope Bay	From Battleship Cove to a point east of a line drawn from Brayton Point to buoy 4 in Mt. Hope Bay and north from Mass.-R.I. state line.			U	SB
32	Mount Hope Bay	Westerly of a line drawn from Brayton Point to Buoy 4 in Mt. Hope Bay in R.I. and northerly from Mass.-R.I. state line.			SB	SB
33	Lee River	Entire length			B	B
34	Cole River	Entire length			B	B
35	Kickimuit River	Entire length			B	B

Total Miles Class B - 90.4
Total Miles Class C - 4.0
Total Miles Unsatisfactory Condition - 99.4

LAKES AND PONDS

There are 221 lakes and ponds in the Taunton River Basin.

Inventory

Taunton River Basin

Number of Lakes and Ponds	221
Surface area of Lakes and Ponds (in acres)	16,255
Number of Lakes and Ponds greater than 10 acres	137
Surface area of Lakes and Ponds greater than 10 acres	15,760
Number of officially recognized Great Ponds	10
Surface area of officially recognized Great Ponds (in acres)	4,730

Classification

Name		Severity Points	Stratified/ Unstratified
Chartley Pond	Attleboro/Norton	13	S
Brockton Reservoir	Avon	8	S
Cleveland Pond	Abington	12	U
South Watuppa Pond	Fall River/Westport	11	U
Island Grove Pond	Abington	10	U
Norton Reservoir	Mansfield/Norton	10	U
Nippenickit Lake	Bridgewater	7	U
Winnecunnet Pond	Norton	7	U
Robbins Pond	Bridgewater	5	U

XXIII - TEN MILE RIVER

The Ten Mile River drains an area of 54 square miles in southeastern Massachusetts and eastern Rhode Island. Originating in Savage's Pond in Plainville, Massachusetts, the stream flows generally southwest through North Attleborough, Attleboro and Seekonk to Pawtucket and East Providence, Rhode Island where it turns northwest and empties into the Seekonk River. The total length of the river is 22 miles, of which 15 are in Massachusetts. The elevation of the riverbed drops from 230 feet above mean sea level at the source to ten feet at the mouth for an average fall of ten feet-per-mile. Flow is highly restricted, with various dams creating a total of 15 impoundments. These impoundments comprise almost half the length of the river. Most of the remaining length is enclosed in concrete or masonry retaining walls which severely affect natural processes.

There are two major tributaries to the Ten Mile--the Bungay and Seven Mile rivers. The former begins in a swamp in North Attleborough and flows south approximately five miles, joining the Ten Mile just above Mechanics Pond in Attleboro. Drainage area of the Bungay is 7.8 square miles. The Seven Mile River drains an area of 12.7 square miles. Flowing south from a marsh just east of North Attleborough center to join the Ten Mile at the state line, its total length, oddly enough, is seven miles.

The Massachusetts portion of the Ten Mile River Basin is primarily located in the towns of Plainville, North Attleborough, and Seekonk and the City of Attleboro. Small parts of Foxborough, Wrentham, Mansfield and Rehoboth are also located within the watershed. In 1975, about 60,000 persons lived in the Massachusetts portion, a density of 1,250 persons per square mile. Urban development within the basin is densest along the river. Land use throughout the basin is estimated to be 46 percent forest, 26 percent urban, 8 percent agriculture, 4 percent water and 16 percent other (including shrub swamps, non-forested recreation land, abandoned agricultural land, etc.).

Land elevations in the basin range from sea level at the outlet to over 400 feet in the northern portion. Low, gently rolling hills are the dominant topographical feature. Much of the lowlands consists of wooded swamp and shrub swamp. Glacial till soils are common in the higher elevations; the lower areas are characterized by soils of glacial outwash materials. The outwash soils are typically sandy and gravelly, while the till soils contain more silt and clay.

The basin has a temperate climate typical of coastal New England. Average annual temperature is about 50°F. The coldest month is February with a mean temperature of 29°F, while the warmest month is July with a mean of 72°F. Freezing temperatures occur over 100 days a year on the average. Precipitation is generally well distributed throughout the year, averaging 44 inches annually. Annual snowfall averages about 34 inches.

Water Quality Surveys

In the summer of 1973, the Division of Water Pollution Control conducted an intensive water quality survey of the Ten Mile River Basin. The survey was conducted during a week in July and a week in September. During each week, samples were collected at 21 stations. Four chemical and bacterial samples were collected from each station over a 24-hour period and composited into one sample. This procedure was done on two days each week. Dissolved oxygen samples were also taken at each station over a 24-hour period on three consecutive days for each survey. Photosynthesis and biological studies were also conducted by Division personnel. The photosynthesis study employed the light and dark bottle technique, while the biological study involved the analyses of sediment for invertebrate organisms. The results of this survey were set forth in the document, Ten Mile River, Part A 1973, published by the Division.

The 1973 survey is the most recent water quality survey conducted by the Division. The present water quality conditions of the basin are estimated to be relatively the same as during the 1973 survey. The Division is scheduled to resurvey the Ten Mile River Basin in 1979.

In the fall of 1977, the Division conducted a wastewater discharge survey of the Ten Mile River Basin. A total of 31 discharges were sampled according to procedures set forth by the United States Environmental Protection Agency. The results of this survey will be published by the Division in the spring of 1978.

Segmentation

In Table 23, the Ten Mile River and its major tributaries are divided into segments based upon major changes in the hydraulic characteristics of the stream and the introduction of major wastewater discharges. The segmentation provides the opportunity to examine the basin in a logical sequence and allows for the determination of water quality at various intervals of the river. The classification in Table 23 is undergoing revision and will be finalized in the spring of 1978.

The following water quality explanation of the Ten Mile River Basin is based upon the analysis of the results of the 1973 water quality survey. The conditions in the basin were much the same in 1977 as in 1973. The wastewater discharges in the basin are basically the same as they were in 1973.

Present Conditions

Segment 1 - Above Plainville Center - Non-fecal coliform bacteria and solids were slightly high in this segment, probably due to land-stripping activities.

Segment 2 - Plainville Center to Whiting Pond Dam - Four industries in Plainville discharge treated effluents; all are inorganic discharges. These effluents contribute to moderately high nutrients in Whiting Pond. Slightly high coliform bacteria indicate septic tank malfunctions in Plainville and North Attleborough; this would also contribute nutrients. Low dissolved oxygen values at the inlet to Whiting Pond are attributed to natural processes in the upstream wetlands.

Segment 3 - Whiting Pond Dam to North Attleborough STP - Several treated effluents from jewelry and metal finishing industries in North Attleborough contribute metals and nutrients. Bottom sediments in this segment are extremely high in metals. Coliform bacteria and solids result from urban runoff and sewer overflows. The temperature increase in Falls Pond may be a natural phenomenon.

Segment 4 - North Attleborough STP to Bungay River - Despite conscientious operation, this facility causes severe dissolved oxygen, BOD, solids, and nutrient problems, primarily because the plant flow equals or exceeds the flow in the river much of the time.

Segment 5 - Bungay River to Attleboro STP - Numerous jewelry and metal finishing industries discharge treated effluents in Attleboro Center, increasing the nutrient problems as well as adding metals. One industry in Attleboro and one in Seekonk discharge untreated or partially treated organic wastes to this segment, adding to the dissolved oxygen, solids, and nutrient problems. Bottom sediments are extremely high in metals.

Segment 6 - Attleboro STP to Central Pond outlet - The effects of the treatment plant are offset somewhat by the entrance of the Seven Mile River. Algal blooms are a major problem in this segment due to nutrients from the treatment plant effluent and upstream sources.

Segment 7 - Central Pond outlet to Seekonk River - Since there are no known point discharges to the Ten Mile River in Rhode Island, problems in this segment must be attributed to either Massachusetts discharges or urban runoff. Slight increases in coliform bacteria and turbidity were noted through East Providence and have been attributed to urban runoff; other problems have been attributed to upstream discharges in Massachusetts.

Setment 8 - Bungay River - Moderately high coliform bacteria, slightly high solids and color, and extremely low dissolved oxygen (especially in late June-early July) are primarily due to natural causes as the river flows through a swamp. It is felt, however, that the discharge from the National Fish Hatchery contributes to these problems.

Segment 9 - Speedway Brook - Treated effluents from jewelry and metal finishing industries in Attleboro contribute nutrients, as evidenced by algal blooms. and metals. Slightly high coliform bacteria results from urban runoff.

Segment 10 - Seven Mile River above Orrs Pond - Agricultural runoff contributes coliform bacteria, BOD, solids, and nutrients to this segment. Leachate from malfunctioning subsurface disposal systems may also be a problem.

Segment 11 - Seven Mile River from Orrs Pond to Ten Mile River - Coliform bacteria levels are slightly high, probably due to urban runoff. Low dissolved oxygen values in late afternoon samples taken during water quality surveys cannot be explained.

Segment 12 - Coles Brook - Slightly high nutrient values were found in this brook during the National Eutrophication Survey of Central Pond and Turner Reservoir. This may be caused by runoff from lawns and a golf course, which would contain nutrients from fertilizers, or by leachate from malfunctioning subsurface disposal systems.

TABLE 23

TEN MILE RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
1	Ten Mile River	Above Plainville Center	Above 19.9	3.2	B	B
2	Ten Mile River	Plainville Center to Whiting Pond Dam	19.9-19.3	0.6	B	B
3	Ten Mile River	Whiting Pond Dam to North Attleborough STP	19.3-15.6	3.7	U	B
4	Ten Mile River	North Attleborough STP to Bungay River	15.6-14.1	1.5	U	C
5	Ten Mile River	Bungay River to Attleboro STP	14.1-7.7	6.4	U	C
6	Ten Mile River	Attleboro STP to Central Pond outlet	7.7-4.7	3.0	U	C
7	Ten Mile River	Central Pond outlet to mouth	4.7-0.0	4.7	U	B
8	Bungay River	Entire length	--	4.5	U	B
9	Speedway Brook	Entire length	--	2.0	U	C
10	Seven Mile River	Above Orrs Pond Dam	Above 2.5	4.5	U	B
11	Seven Mile River	Orrs Pond to Ten Mile River	2.5-0.0	2.5	U	B
12	Coles Brook	Entire length	--	1.5	U	B

Total Miles of Class B - 3.8
Total Miles of Class C - 0.0
Total Miles of Unsatisfactory Condition - 34.3

LAKES AND PONDS

There are 50 lakes and ponds located in the Ten Mile River Basin. In 1975, the Division conducted a one-day baseline survey of Falls Pond, located in North Attleborough. The following tables are from the Division's Lake Classification Program:

Inventory

Ten Mile River Basin

Number of Lakes and Ponds	50
Surface area of Lakes and Ponds (in acres)	1,565
Number of Lakes and Ponds greater than 10 acres	27
Surface area of Lakes and Ponds greater than 10 acres	1,438
Number of officially recognized Great Ponds	0

Classification

Name	Location	Severity Points	Stratified / Unstratified
Falls Pond	North Attleborough	10	S

XXIV - WESTFIELD RIVER BASIN

The Westfield River Basin covers 517 square miles of west-central Massachusetts and includes portions of Franklin, Hampshire, Hampden, and Berkshire counties. Sparsely populated in the upper reaches, the basin's population is concentrated in the southeastern corner in the municipalities of Agawam, Holyoke, Westfield, and West Springfield.

The Westfield River begins in Savoy at a point over 2,000 feet above sea level. Flowing southeast, with ridges rising 500 to 900 feet above the adjacent valleys, the river remains mostly in its natural state, surrounded by second- and third-growth forest cover. The tops of the hills have been rounded and scoured by glaciation exposing bedrock through the thin till cover. Dropping 1,000 feet in the first 14 miles, the river swiftly makes its way to Huntington where it is joined by the Middle and West Branches. An area of unique beauty and natural recreational advantages (as well as the newly-constructed Knightville Reservoir), it is enjoyed by sportsmen and naturalists.

Below Huntington the river flows over three dams in succession and the river slope decreases as it approaches the Town of Westfield. The Westfield River is joined by the Little River 11 miles above its mouth, just as the river is reaching the floodplain of the Connecticut River. The river deepens and winds its way through Robinson State Park and over one more dam in West Springfield before it joins the Connecticut.

The Middle Branch of the Westfield River begins in the Town of Peru and flows 18 miles to join the Main Branch 27 miles above its mouth. Falling 1,250 feet along its course, the Middle Branch has a drainage area of 52.6 square miles and an average flow of 102 cfs at the United States Geological Survey Gage just above its confluence with the Main Branch.

In Becket, the West Branch of the Westfield River is formed by the confluence of Depot and Yokum brooks. This Branch flows 17.5 miles through Becket, Middlefield and Chester, falling 840 feet before joining the Main Branch in Huntington 25 miles above its mouth. At the United States Geological Survey Gage 1.5 miles upstream of its confluence, the West Branch has an average flow of 182 cfs and drains an area of 93.7 square miles.

The Little River, often referred to as the Westfield Little River because of another tributary stream in Huntington with the same name, begins at the outlet of Cobble Mountain Reservoir in Blandford. From the outlet the river flows 13 miles through Russell and Westfield to join the Westfield River 11 miles above its mouth.

Major industries in the basin include the manufacture of paper and abrasives. These are "wet" industries and result in waste discharges to the rivers. With the rise of the economic importance of recreation to the area, it becomes more important to share the Westfield River's 930 cfs average flow to include all of its varied uses. Water resources are, therefore, vitally important to the area.

Water Quality Surveys

During the summer of 1972, the Massachusetts Division of Water Pollution Control and the United States Environmental Protection Agency combined their efforts for a comprehensive water quality survey on the Westfield River Basin. In September 1974, the Division of Water Pollution Control conducted another similar study of the basin as part of a continuing water quality monitoring and analyzing process carried on by the Water Resources Commission.

The 1972 survey included 12 sampling stations on the Westfield and Little rivers that were sampled four times daily on August 29 and 31. The 1974 survey included 16 stations that were sampled six times daily on September 10, 11, and 12.

Results of these surveys have been published in The Westfield River Water Quality Data, Part A, 1972 and 1974 by the Massachusetts Division of Water Pollution Control.

During the summer of 1978, another intensive water quality survey on the Westfield River will be conducted by the Division.

Segmentation

The major streams of the Westfield River Basin include the Westfield and Little rivers. Two small brooks are also located in the basin. They are Powdermill Brook and an unnamed brook.

The two brooks have been designated as consisting of one segment each. The Westfield and Little rivers have been broken into segments to better identify specific areas where problems may exist. Segment boundaries have been defined by dams, bridges, and at confluences with other streams.

Table 24 defines each segment's boundaries as to geographical location, river mile points, and length in miles. It also lists the present condition of each segment and the future use classification, according to the present water quality standards.

Present Conditions

Segment 0 - Above the confluence of the West Branch and the West Branch above the Town of Chester - The upper reaches of the Westfield River flow through mountainous terrain covered with a relatively thin layer of permeable soil. This allows extreme and frequent variations in flow due to runoff. Erosion due to runoff subjects the streams to heavy silt loads and fluctuations in coliform densities. Water quality standards do not apply to conditions brought about by natural causes. Therefore, this segment of the Westfield River does not violate its A and B classifications.

Segment 1 - Lower West Branch and the main stem to Crescent Mills Dam - Along the lower West Branch and the main stem of the Westfield River to Crescent Mills, Class B coliform criteria are continually violated. High coliform densities are due to the discharge of raw sewage from the towns of Chester and Huntington. In addition, the discharge of untreated industrial wastewater from Bendix Abrasives constitutes a violation of Class B standards.

Segment 2 - Crescent Mills Dam to Russell Falls Dam - From the Crescent Mills Dam to the Russell Falls Dam, Class B coliform criteria continue to be violated owing to a carryover effect from Segment 1. Texon, Inc., a paper company, discharges at the top of this segment, but treats its wastewater.

Segment 3 - Russell Falls Dam to Woronoco Dam - This segment receives the discharges of the Russell STP and the Westfield River Paper Company. Coliform densities fall in this segment but still occasionally violate Class B criteria. Russell's small,extended aeration plant has occasional problems with overloads caused by infiltration. Westfield River Paper Company has only an intermittent discharge from a lagoon system. During the 1974 water quality survey, the occasional overflow from the lagoons to the river caused a rise in nutrient and suspended solids levels in the impoundment below Woronoco. The problems occurring in this segment will be further documented by a survey to be conducted on the Westfield River in 1978.

Segment 4 - Woronoco Dam to Little River confluence - Previously, untreated industrial wastewater from Strathmore Paper Company and raw sewage from the mill houses polluted this segment. Solids, color, and total coliform densities violated Class B criteria and aesthetically degraded the river. During low flow conditions, dissolved oxygen criteria were violated in the upper portion of this segment. High reaeration rates allowed oxygen values to recover quickly and the present condition of the segment is C. The Strathmore Paper Company has since constructed its own wastewater treatment plant and commenced operation on February 28, 1977. Unfortunately, the mill houses on the opposite bank still discharge raw sewage into the river. Again, the 1978 survey will provide data for a re-evaluation of the existing conditions in the segment.

Segment 5 - Little River, source to Cobble Mountain Reservoir Dam - The waters of Cobble Mountain Reservoir are used for a public water supply. The reservoir and its feeder streams have a water use classification of A and are designated as an anti-degradation segment. The Division of Environmental Health monitors the water quality in this segment.

Segment 6 - Little River, Cobble Mountain Reservoir Dam to Horton's Bridge - In this segment the backwash of the filters used for the public water supply is discharged to the Little River. This resulted in relatively high suspended solids values in the stream during the 1974 water quality survey. Flow regulation imparted by Cobble Mountain Reservoir can result in prolonged periods of low flow below the dam. Releases from the reservoir can cause wide variations in stream temperatures and flow regimes during the course of a day. Class B coliform criteria are sometimes violated in this segment. This is probably due to non-point sources from pasture land that abuts the stream along this segment.

Segment 7 - Little River, Horton's Bridge to confluence with Westfield River- Violations of Class C criteria did not occur in this segment during the last water quality survey. Stevens Paper Mills discharges from two mills in this segment. The upper mill does not treat its wastewater. During the 1974 water quality survey, however, the mill was under greatly reduced production. Treatment will be provided at this mill. The wastewater from the lower mill is effectively treated. Toward the confluence of the Little and Westfield Rivers, Columbia Manufacturing Company discharges treated wastewater to the Little River. Three-tenths of a mile upstream from the confluence is the discharge of an untreated municipal combined sewer. The impact of this wastewater is exerted primarily on the main stem of the Westfield River.

Segment 8 - Powdermill Brook, from mile point 2.6 to confluence with Westfield River - Powdermill Brook receives the discharge from Sterling Radiator Company. No known violations of Class B criteria occur.

Segment 9 - Unnamed brook, from mile point 0.6 to confluence with Westfield River - An unnamed brook carries the discharge from the Western Massachusetts Hospital to the Westfield River. This small discharge is treated, and no known violations of Class B criteria occur.

Segment 10 - Confluence with Little River to West Springfield Dam - The combined effects of carryover from upstream discharges on the Westfield and Little Rivers along with untreated combined sewers in the Town of Westfield pollute this segment. Total coliform densities greatly exceed Class B criteria. During low flow conditions, the D.O. content of the stream is depleted. Survey results show that diurnal fluctuations caused by algae were partially responsible for this violation. Therefore, the nutrient fertilization of the stream must be considered a problem at this time. Floating solids and color also degrade the segment. Settled sludge rises to the surface throughout this segment as a result of anaerobic activity in the stream bed.

This segment is the focal point of the stream's oxygen demands because of its relatively low reaeration rates and the lengthy time of travel. Because of the total number of violations and the general aesthetic degradation of the river, the present condition is unsatisfactory in this segment.

Segment 11- West Springfield Dam to confluence with Connecticut River - This last segment of the Westfield River has high solids, color, and nutrient levels due to carryover from Segment 10. However, higher reaeration rates prevent violations of Class B dissolved oxygen criteria. High total coliform densities are the result of both carryover and non-point sources.

TABLE 24

WESTFIELD RIVER BASIN

CLASSIFICATION - SEGMENTATION

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	MILES	PRESENT CONDITION	CLASSIFICATION
0	Westfield River	Above the confluence of the West Branch and the West Branch above the Town of Chester	62.5-25.0 25.0 + 17.5-7.5	65.5	A&B	A&B
1	Westfield River	Lower West Branch and the main stem to Crescent Mills Dam	25.0+7.5-0.0 24.0-24.0	8.5	C	B
2	Westfield River	Crescent Mills Dam to Russell Falls Dam	24.0-21.1	2.9	C	B
3	Westfield River	Russell Falls Dam to Woronoco Dam	21.1-18.5	2.6	C	B
4	Westfield River	Woronoco Dam to Little River confluence	18.5-11.1	7.4	C	B
5	Little River	Source to Cobble Mountain Reservoir Dam	11.1 + above 13.0	7.0	A	A
6	Little River	Cobble Mountain Reservoir Dam to Horton's Bridge	11.1 + 13.0-4.7	8.3	C	B
7	Little River	Horton's Bridge to confluence with Westfield River	11.1 + 4.7-0.0	4.7	C	C
8	Powdermill Brook	From mile point 2.6 to confluence with Westfield River	10.0 +	2.6	B	B
9	Unnamed brook	From mile point 0.6 to confluence with Westfield River	8.5 + 0.6-0.0	0.6	B	B
10	Westfield River	From confluence with Little River to the West Springfield Dam	11.1-3.9	7.2	U	B
11	Westfield River	From West Springfield Dam to confluence with the Connecticut River	3.9-0.0	3.9	C	B

Total Miles of Class A - 7.0
Total Miles of Class B - 68.7
Total Miles of Class C - 38.3
Total Miles of Unsatisfactory Conditions - 7.2

LAKES AND PONDS

Inventory

Number of Lakes and Ponds	78
Surface area of Lakes and Ponds (acres)	4,422
Number of Lakes and Ponds greater than 10 acres	48
Surface area of Lakes and Pond greater than 10 acres	4,264
Number of officially recognized Great Ponds	10
Surface area of officially recognized Great Ponds (acres)	1,059

Classification

No lakes or ponds have been classified.

SUMMARY

The Commonwealth of Massachusetts is divided into twenty-four major drainage basins for the purpose of water quality management planning. Together, these basins drain some 11,057 square miles and comprise 1,685 major river miles.

Table 25 summarizes the total miles presently meeting Class B criteria, as well as the miles not meeting their present classification for each of the river basins. As can be seen by this table, there are presently 636 major river miles currently meeting Class B criteria.

There has been a great deal of improvement throughout the state over the past year. This is best indicated by the fact that 37.8 percent of Massachusetts' major river miles are now known to be meeting state water quality standards--an improvement of 5.6 percent over last year's figure.

Although the present quality of many of the state's streams are below desired levels, the causes of degradation are known and the necessary abatement measures have been given high priority so that 1983 fishable/swimmable goals can be met. Cost for construction of publicly-owned wastewater treatment facilities to help reach these goals have been assessed at $3,400,433,000 according to the 1976 Needs Survey prepared by the Environmental Protection Agency.

It appears from analysis of preliminary data that non-point sources are a significant source of water pollution in many of Massachusetts' river basins. Evaluation of the extent and methods of controlling these sources will be addressed in the Areawide Wastewater Management Plans currently being prepared. The costs of non-point source abatement will also be evaluated in these reports.

The current Massachusetts Water Quality Standards are being revised. Under these revisions, most of the waters of the Commonwealth will be assigned a B classification. At this time it is not entirely clear how many of these segments will not be meeting this B classification by 1983. However, this will be evaluated in Phase II water quality management plans, which are currently being formulated by this Division.

A number of high quality streams are now protected by the anti-degradation regulation of the present water quality standards. These regulations prevent new discharges of wastewater into the water course upstream of the most upstream discharge of wastewater from a municipal waste treatment facility. Any existing discharge into these waters must connnect to a municipal sewer or, if a sewer is not available, must provide the highest and best practical means of waste treatment presently available.

TABLE 25

COMMONWEALTH OF MASSACHUSETTS

305 (b) WATER QUALITY INVENTORY SUMMARY

DRAINAGE BASIN		RIVER BASIN OR COASTAL DRAINAGE (MAIN STEM AND MAJOR TRIBUTARIES)	TOTAL MILES ASSESSED	MILES NOW MEETING CLASS B	MILES NOW MEETING STATE WQ STANDARDS	MILES NOT MEETING STATE WQ STANDARDS
Blackstone		328	201.1	111.3	111.3	89.8
Boston Harbor						
Mystic		64	20.3	0.0	0.9	19.4
Neponset		123	21.7	0.0	6.9	14.8
Buzzards Bay		350	44.5	37.0	37.0	7.5
Cape Cod		410	58*	4 *	39 *	13 *
Charles River		265	89.7	1.4	1.4	88.3
Chicopee		720	111.5	49.4	72.2	39.3
Connecticut		2,949	81.8	32.2	32.2	49.6
Deerfield		666	80.2	67.9	67.9	12.3
Farmington	(total)	602	18.4	18.4	18.4	0.0
	(Mass.)	149				
French & Quinebaug		241	56.5	20.2	29.1	27.4
Hoosic	(total)	713	38.7	17.3	19.6	19.1
	(Mass.)	165				
Housatonic	(total)	1,950	96.3	56.3	56.3	40.0
	(Mass.)	500				
Ipswich & Parker		155	70.9	0.0	0.0	70.9
The Islands		100	2*	0*	0*	2*
Merrimack	(total)	5,000	115.4	3.6	0.0	115.4
	(Mass.)	1,200				

TABLE 25 (CONTINUED)

DRAINAGE BASIN		RIVER BASIN OR COASTAL DRAINAGE (MAIN STEM AND MAJOR TRIBUTARIES)	TOTAL MILES ASSESSED	MILES NOW MEETING CLASS B	MILES NOW MEETING STATE WQ STANDARDS	MILES NOT MEETING STATE WQ STANDARDS
Millers	(total)	390	57.5	17.3	17.3	40.2
	(Mass.)	350				
Nashua		530	108.2	9.9	9.9	98.3
North Coastal		138	15*	4* **	3*	12*
North River		105.4	22	12.8	12.7	9.3
South Coastal		72	6*	1* **	2*	4*
SUASCO		406	88.1	1.4	1.4	86.7
Sudbury	169					
Assabet	175					
Concord	62					
Taunton		530	203.8	100.4	100.4	103.4
Ten Mile		49	38.1	3.8	3.8	34.3
Westfield		517	121.2	75.7	73.4	47.8
TOTAL		11,082.4	1,685.9	636.3	672.1	1,013.8
% of Total Miles				37.8	39.9	60.1

* Number of Segments
** Includes SB

REFERENCES

Brown, R.I., N.I. McClelland, R.A. Deininger, and R.G. Tozer, "A Water Quality Index - Do We Dare," Water and Sewage Works, p.339-343, October 1970.

Ott, W.R., Water Quality Indices: A Survey of Indices Used in the United States, U.S. Environmental Protection Agency, EPA-600/4-78-005, 1978.

APPENDIX I

COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION
DIVISION OF WATER POLLUTION CONTROL

RULES AND REGULATIONS FOR THE ESTABLISHMENT OF MINIMUM WATER QUALITY STANDARDS AND FOR THE PROTECTION OF THE QUALITY AND VALUE OF WATER RESOURCES

The Division of Water Pollution Control, acting under the authority of Sections 27 (5) and (12) of Chapter 21 of the General Laws and other Acts relating thereto enabling, hereby adopts and established the following Rules and Regulations to restore, maintain, and enhance the quality of the waters of the Commonwealth; to designate the uses for which the various waters of the state shall be maintained and protected; to prescribe the water quality standards required to sustain the designated uses; and prescribe regulations necessary for implementing, achieving and maintaining the prescribed water quality.

Filed with Secretary of State May 2, 1974

RULES AND REGULATIONS
FOR THE ESTABLISHMENT OF
MINIMUM WATER QUALITY STANDARDS
AND FOR THE PROTECTION OF THE
QUALITY AND VALUE OF WATER RESOURCES

REGULATION I Definitions

The terms used in the following regulations are defined as follows:

1. Appropriate Treatment - means that degree of treatment required for the waters of the Commonwealth to meet their assigned classifications or any terms, conditions, or effluent limitations established as part of any permit to discharge issued under the provisions of the Massachusetts Clean Waters Act, or any effluent standard or prohibition established by the Division under authority of Section 27 (6) of the Massachusetts Clean Waters Act.

2. Division - means the Commonwealth of Massachusetts, Division of Water Pollution Control.

3. Person - means any agency or political subdivision of the Commonwealth, public or private corporation or authority, individual, partnership or association, or other entity, including any officer of a public or private agency or organization, upon whom a duty may be imposed by or pursuant to any provision of Sections 26-53 inclusive, of Chapter 21 of the General Laws.

4. Sewage - means the water-carried waste products or discharges from human beings, sink wastes, wash water, laundry waste and similar so-called domestic waste.

5. The "Waters of the Commonwealth" and "Waters" - means all waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, coastal waters, and ground waters.

6. Fresh Waters - means waters not subject to the rise and fall of the tide.

7. Salt Waters - means all waters subject to the rise and fall of the tide.

8. Cold Water Stream - means a stream capable of sustaining a population of cold water fish, primarily Salmonids.

9. Seasonal Cold Water Stream - means a stream which is only capable of sustaining cold water fish during the period of September 15 through June 30.

10. Waste Treatment Facility - processes, plants, or works, installed for the purpose of treating, neutralizing, stabilizing or disposing of wastewater.

11. Pollutant - means any element or property of sewage, agricultural, industrial, or commercial waste, run-off, leachate, heated effluent, or other matter in whatever form and whether originating at a point or non-point source, which is or may be discharged, drained or otherwise introduced into the waters of the Commonwealth.

12. Discharge - means the flow or release of any pollutant into the waters of the

Commonwealth.

13. Wastewater - means sewage, liquid or water-carried waste from industrial, commercial, municipal, private or other sources.

14. Zone of Passage - means a continuous water route of the volume, area and quality necessary to allow passage of free-swimming and drifting organisms with no significant effect produced on the population.

Regulation II - Water Quality Standards

1 - The Water Quality Standards adopted by the Massachusetts Division of Water Pollution Control on March 3, 1967 and filed with the Secretary of State on March 6, 1967 are hereby repealed, except that existing "River Basin Classifications" based on the 1967 Standards will remain in full force and effect until reclassified in accordance with the following standards.

2 - To achieve the objectives of the Massachusetts Clean Waters Act and the Federal Water Pollution Control Act Amendments of 1972 and to assure the best use of the waters of the Commonwealth the following standards are adopted and shall be applicable to all waters of the Commonwealth or to different segments of the same waters:

3 - Fresh Water Standards

Class A - These waters are designated for use as sources of public water supply in accordance with the provisions of Chapter 111 of the General Laws.

Water Quality Criteria

Item	Criteria
1. Dissolved oxygen	Not less than 75% of saturation during at least 16 hours of any 24 hour period and not less than 5 mg/l at any time. For cold water streams the dissolved oxygen concentration shall not be less than 6 mg/l. For seasonal cold water streams the dissolved oxygen concentration shall not be less than 6 mg/l during the season.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None allowable
3. Color and turbidity	None other than natural origin.
4. Total Coliform bacteria per 100 ml.	Not to exceed an average value of 50 during any monthly sampling period.
5. Taste and odor	None other than of natural origin.
6. pH	As naturally occurs.
7. Allowable temperature increase	None other than of natural origin.
8. Chemical constituents	None in concentrations or combinations which would be harmful or offensive to humans, or harmful to animal or aquatic life.

9. Radioactivity	None other than that occurring from natural phenomena.

Class B - These waters are suitable for bathing and recreational purposes, water contact activities, acceptable for public water supply with treatment and disinfection, are an excellent fish and wildlife habitat, have excellent aesthetic values and are suitable for certain agricultural and industrial uses.

Item	Criteria
1. Dissolved oxygen	Not less than 75% of saturation during at least 16 hours of any 24 hour period and not less than 5 mg/l at any time. For cold water streams the dissolved oxygen concentration shall not be less than 6 mg/l. For seasonal cold water streams the dissolved oxygen concentration shall not be less than 6 mg/l during the season.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from water treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3. Color and turbidity	None in such concentrations that would impair any uses specifically assigned to this class.
4. Coliform bacteria per 100 ml	Not to exceed an average value of 1000 nor more than 1000 in 20% of the samples.
5. Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish.
6. pH	6.5 - 8.0
7. Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case

	exceed 83° F in warm water fisheries, and 68°F in cold water fisheries, or in any case raise the normal temperature of the receiving water more than 4°F.
8. Chemical constituents	None in concentrations or combinations which would be harmful or offensive to human, or harmful to animal or aquatic life or any water use specifically assigned to this class.
9. Radioactivity	None in concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Class B1 - The use and criteria for Class B1 shall be the same as for Class B with the exception of the dissolved oxygen requirement which shall be as follows for this class:

Item	Criteria
1. Dissolved oxygen	Not less than 5 mg/l during at least 16 hours of any 24 hour period, nor less than 3 mg/l at any time. For seasonal cold water fisheries at least 6 mg/l must be maintained during the season.

Class C - These waters are suitable for recreational boating and secondary water contact recreation, as a suitable habitat for wildlife and fish indigenous to the region, for certain agricultural and industrial uses, have good aesthetic values, and under certain conditions are acceptable for public water supply with treatment and disinfection.

Item	Criteria
1. Dissolved oxygen	Not less than 5 mg/l during at least 16 hours of any 24 hour period, nor less than 3 mg/l at any time. For seasonal cold water fisheries at least 6 mg/l must be maintained during the season.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result

		from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3.	Color and turbidity	None allowable in such concentrations that would impair any uses specifically assigned to this class.
4.	Coliform bacteria	None in such concentrations that would impair any usages specifically assigned to this class, see Note 1.
5.	Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class, and none that would cause taste and odor in edible fish.
6.	pH	6.0 - 8.5
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive receiving water use and in no case exceed 83°F in warm water fisheries, and 68°F in cold water fisheries, or in any case raise the normal temperature of the receiving water more than 4°F.
8.	Chemical constituents	None in concentrations or combinations which would be harmful or offensive to human life, or harmful to animal or aquatic life or any other water use specifically assigned to this class.
9.	Radioactivity	None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Note I - no bacteria limit has been placed on Class "C" waters because of the urban runoff and combined sewer problems which have not yet been solved. In waters of this class not subject to urban runoff or combined sewer discharges the bacterial quality of the water should be less than an average of 5,000 coliform bacteria/100 ml during any monthly sampling period. It is the objective of the Division to eliminate all point and non-point sources of pollution and to impose bacterial limits on all waters.

Class C1 - The use and criteria for Class C1 shall be the same as for Class C with the exception of the dissolved oxygen (and temperature) requirements which shall be as follows for this Class:

Item	Criteria
1. Dissolved oxygen	Not less than 2 mg/l at any time.

Salt Water Standards

Class SA - These are waters of the highest quality and are suitable for any high water quality use including bathing and other water contact activities. These waters are suitable for approved shellfish areas and the taking of shellfish without depuration, have the highest aesthetic value and are an excellent fish and wildlife habitat.

Water Quality Criteria

Item	Criteria
1. Dissolved oxygen	Not less than 6.5 mg/l at any time.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3. Color and turbidity	None in such concentrations that will impair any uses specifically assigned to this class.
4. Total Coliform bacteria per 100 ml	Not to exceed a median value of 70 and not more than 10% of the samples shall ordinarily exceed 230 during any monthly sampling period.
5. Taste and odor	None allowable
6. pH	6.8 - 8.5

7.	Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other uses.
9.	Radioactivity	None in concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Class SB - These waters are suitable for bathing and recreational purposes including water contact sports and industrial cooling, have good aesthetic values, are an excellent fish habitat and are suitable for certain shell fisheries with depuration (Restricted Shellfish Areas).

Item		Criteria
1.	Dissolved oxygen	Not less than 5.0 mg/l at any time.
2.	Sludge deposits-solid refuse-floating solids-oils-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing adequate treatment. For oil and grease of petroleum origin, the maximum allowable concentration is 15 mg/l.
3.	Color and turbidity	None in such concentrations that would impair any uses specifically assigned to this class.
4.	Total Coliform bacteria per 100 ml	Not to exceed an average value of 700 and not more than 1000 in more than 20% of the samples.
5.	Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish.
6.	pH	6.8 - 8.5

7.	Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other use.
9.	Radioactivity	None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Class SC - These waters are suitable for aesthetic enjoyment, for recreational boating, as a habitat for wildlife and common food and game fishes indigenous to the region, and are suitable for certain industrial uses.

Item		Criteria
1.	Dissolved oxygen	Not less than 5 mg/l during at least 16 hours of any 24 hour period nor less than 3 mg/l at any time.
2.	Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilitie providing appropriate treatment. For oi and grease of petroleum origin the maximum allowable concentration is 15 mg
3.	Color and turbidity	None in such concentrations that would impair any uses specifically assigned to this class.
4.	Total Coliform bacteria	None in such concentrations that would impair any uses specifically assigned to this class. See Note 2
5.	Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish or shellfi
6.	pH	6.5 - 8.5
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limits on the mos sensitive water use.

8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other use.
9. Radioactivity	None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Note 2: no bacteria limit has been placed on Class "SC" waters because of the urban runoff and combined sewer problems which have not yet been solved. In waters of this class not subject to urban runoff or combined sewer discharges, the bacterial quality of the water should be less than an average of 5,000 coliform bacteria/100 ml during any monthly sampling period. It is the objective of the Division to eliminate all point and non-point sources of pollution and to impose bacterial limits on all waters.

Regulation III - General Provisions

1. It is recognized that certain waters of the Commonwealth possess an existing quality which is better than the standards assigned thereto.

   A. Except as otherwise provided herein, no new discharge of wastewater will be permitted into any stream, river or tributary upstream of the most upstream discharge of wastewater from a municipal waste treatment facility or municipal sewer discharging wastes requiring appropriate treatment as determined by the Division. Any person having an existing wastewater discharge shall be required to cease such discharge and connect to a municipal sewer unless it is shown by said person that such connection is not available or feasible. Existing discharges not connected to a municipal sewer will be provided with the highest and best practical means of waste treatment to maintain high water quality. New discharges from a municipal waste treatment facility into such waters will be permitted provided that such discharge is in accordance with a plan developed under the provisions of Section 27(10) of Chapter 21 of the General Laws (Massachusetts Clean Waters Act) which has been the subject of a Public Hearing and approved by the Division. The discharge of industrial liquid coolant wastes in conjunction with the public and private supply of heat or electrical power may be allowed provided that a permit has been issued by the Division and that such discharge is in conformance with the terms and conditions of the permit and in conformance with the water quality standards of the receiving waters.

   B. Except as otherwise provided herein, no new discharge of wastewater will be permitted in Class SA or SB waters. Any person having an existing discharge of wastewater into Class SA or SB waters will be required to cease said discharge and to connect to a municipal sewer unless it is shown by said person that such connection is not available or feasible. Existing discharges not connected to a municipal sewer will be provided with the highest and best practical means of waste treatment to maintain high water quality. New discharges from a waste treatment facility into such waters will be permitted provided such discharge is in accordance with a plan developed under the provisions of Section 27(10) of Chapter 21 of the General Laws (Massachusetts Clean Waters Act) which has been the subject of a Public Hearing and approved by the Division. The discharge of industrial coolant wastes in conjunction with the public and private supply of heat or electrical power may be allowed provided that a permit has been issued by the Division and that such discharge is in conformance with the terms and conditions of the permit and in conformance with the Water Quality Standards of the receiving waters.

2. The latest edition of the Federal publication "Water Quality Criteria" will be considered in the interpretation and application of bioassay results.

3. The latest edition of Standard Methods for Examination of Water and Wastewater, American Public Health Association, will be followed in the collection, preservation, and analysis of samples. Where a method is not given in the standards methods, the latest procedures of the American Society for Testing Materials (ASTM) will be followed.

4. The average minimum consecutive 7-day flow to be expected once in 10 years shall be used in the interpretation of the standards.

5. In the discharge of waste treatment plant effluents into receiving waters, consideration shall be given both in time and distance to allow for mixing of effluent and stream. Such distances required for complete mixing shall not effect the water use classifications adopted by the Division. However, a zone of passage must be provided wherever mixing zones are allowed.

6. There shall be no new discharges of nutrients into lakes or ponds. In addition, there shall be no new discharge of nutrients to tributaries of lakes or ponds that would encourage eutrophication or growth of weeds or algae in these lakes or ponds.

7. Any existing discharge containing nutrients in concentrations which encourage eutrophication or growth of weeds or algae shall be treated to remove such nutrients to the maximum extent technically feasible.

8. These Water Quality Standards do not apply to conditions brought about by natural causes.

9. All waters shall be substantially free of products that will (1) unduly affect the composition of bottom fauna, (2) unduly affect the physical or chemical measure of the bottom, (3) interfere with the spawning of fish or their eggs.

10. No person shall discharge any pollutants into any waters of the Commonwealth which shall cause a violation of the standards.

11. A person shall submit to the Division for approval all plans for the construction of or addition to any waste treatment facility and no such facility may be constructed, modified or enlarged without such approval.

12. Cold water and seasonal cold water streams shall be those listed by the Massachusetts Division of Fisheries and Game.

13. Whoever violates any provision of these regulations shall (a) be fined not less than two thousand five hundred dollars nor more than twenty-five thousand dollars for each day of such violation or its continuance, or by imprisonment for not more than one year, or by both; or (b) shall be subject to a civil penalty not to exceed ten thousand dollars per day of such violation, which may be assessed in an action brought on behalf of the Commonwealth in any court of competent jurisdiction, pursuant to Section 42 of Chapter 21 of the Massachusetts General Laws.

14. The Division and its duly authorized employees shall have the right to enter at all reasonable times into or on, any property, public or private, for the purpose of inspecting and investigating conditions relating to pollution or possible pollution of any waters of the Commonwealth, pursuant to Section 40 of Chapter 21 of the Massachusetts General Laws.

15. If any regulation, paragraph, sentence, clause, phrase or word of these regulations shall be declared invalid for any reason whatsoever, that decision shall not affect any other portion of these regulations, which shall remain in full force and effect and to this end the provisions of these regulations are hereby declared severable.

APPENDIX II

MAJOR ANTI-DEGRADATION STREAMS

BLACKSTONE RIVER BASIN

STREAM	MUNICIPALITY
Kettle Brook above Waite Pond Dam	Leicester
Unnamed brook below Cross Street	Leicester
Lynde Brook	Leicester
First Dark Brook	Auburn
Second Dark Brook	Auburn
Beaver Brook	Worcester
Coes Brook	Worcester
Tatnuck Brook	Worcester
Weasel Brook	Worcester
Singletary Brook	Millbury
Dorothy Brook	Millbury
Cold Spring Brook	Sutton
Cronin Brook	Grafton
Emerson Brook	Uxbridge
Bacon Brook	Uxbridge
Aldrich Brook	Blackstone
Fox Brook	Blackstone
Coal Mine Brook	Worcester
Poor Farm Brook	Worcester
Sewall Brook	Shrewsbury
Tilly Brook	Worcester
West Brook	Shrewsbury
Meadow Brook	Shrewsbury
Big Bummet Brook	Grafton
Axtell Brook	Grafton
Mumford River above East Douglas	Douglas
Southwick Brook	Douglas
Wellman Brook	Douglas
Dunleavey Brook	Uxbridge
Streamburg Brook	Sutton
Purgatory Brook	Sutton
Farrel Brook	Uxbridge
Cold Spring Brook	Uxbridge
West River above Hartford Avenue	Upton
Warren Brook	Upton
Center Brook	Upton

STREAM	MUNICIPALITY
Miscoe Brook	Upton
Taft Pond Brook	Upton
Meadow Brook	Uxbridge
Still Corner Brook	Uxbridge
Mill River above Hopedale Center Dam	Hopedale
Muddy Brook	Mendon
Round Meadow Brook	Mendon
Hop Brook	Blackstone
Quick Stream	Blackstone
Peters River	Bellingham
All intermittent streams	---
All tributaries to the above named streams	---

BOSTON HARBOR

Mystic River Basin

Aberjona River	Reading, Winchester, Woburn
Hall's Brook	Woburn
Sweetwater Brook	Stoneham
Horn Pond Brook	Woburn
Upper Mystic Lake	Winchester, Arlington, Medford
Lower Mystic Lake	Arlington, Medford
Mill Brook	Arlington
Mystic River to Amelia Earhart Dam	Arlington, Medford, Somerville
Alewife Brook, Little River	Arlington, Somerville
Malden River	Malden, Medford, Everett
All intermittent streams	---
All tributaries, named or unnamed, to the above streams	---

Weymouth Fore and Back River Basins

Weymouth Fore River	Braintree
Weymouth Fore River Estuary	Braintree
Weymouth Back River	Weymouth
Weymouth Back River Estuary	Weymouth
Blue Hill River	Randolph
Farm River	Braintree
Cochato River	Randolph

STREAM	MUNICIPALITY
Monatiquot River	Braintree
Glovers Brook	Randolph
Tumbling Brook	Holbrook
Cranberry Brook	Braintree
Smelt Brook	Braintree
Lee Brook	Randolph
Fresh River	Hingham
Old Swamp River	South Weymouth
Mill River	Weymouth
All other named or unnamed streams and tributaries thereto	---
All intermittent streams	---

Neponset River Basin

Neponset River above Baker Chocolate Dam	Milton
Beaver Brook	Sharon
Hawes Brook	Norwood
Massapoag Brook	Sharon-Canton
Mine Brook	Medfield-Walpole
Pine Tree Brook	Milton
Ponkapoag Brook	Canton
Purgatory Brook	Norwood
School Meadow Brook	Walpole
Trap Hole Brook	Walpole
All intermittent streams	---
All other named and unnamed streams	---

BUZZARDS BAY BASIN

Westport River - West Branch	Westport
Simon Brook	Westport
Angeline Brook	Westport
Dunhams Brook	Westport
Westport River - East Branch	Westport
Bread and Cheese Brook	Westport
Kirby Brook	Westport
Snell Creek	Westport
Allen Creek	Westport
Shingle Island River	Dartmouth
Copicut River	Fall River

STREAM	MUNICIPALITY
Paskamanset River	Dartmouth
Destruction Brook	Dartmouth
Slocums River	Dartmouth
Buttonwood Brook	Dartmouth
Acushnet River to Sawmill Pond outlet	Acushnet
Deep Brook	Acushnet
Nasketucket River	Fairhaven
Swift Brook	Fairhaven
Mattapoisett River	Rochester
Branch Brook	Rochester
Aucoot Creek	Marion
Sippican River	Marion
West Branch, Sippican River	Rochester
East Branch, Sippican River	Rochester
Sherman Brook	Rochester
Doggett Brook	Rochester
Hales Brook	Wareham
Cohackett Brook	Wareham
Weweantic River	Carver
South Meadow Brook	Carver
Beaverdam Brook	Carver
Rocky Meadow Brook	Middleborough
Double Brook	Middleborough
East Rocky Gutter Brook	Middleborough
West Rocky Gutter Brook	Middleborough
Indian Brook	Carver
Crane Brook	Carver
Tilson Brook	Carver
Beaverdam Creek	Wareham
Wankinco River	Carver/Plymouth
Frogfoot Brook	Carver
Rose Brook	Wareham
Harlow Brook	Wareham
Broad Marsh River	Wareham
Crooked River	Wareham
Agawam River to Wareham STP	Plymouth/Wareham

STREAM	MUNICIPALITY
Maple Springs Brook, East Branch	Wareham
Gibbs Brook	Wareham
East River	Wareham
Red Brook	Wareham/Plymouth
Herring Brook	Bourne

CAPE COD BASIN

All freshwater streams, including:	
Bridge Creek	Barnstable
Marston Mills River	Barnstable
Santuit River	Barnstable
Stony Brook	Brewster
Coonamesset River	Falmouth
Quashnet River	Falmouth
Childs River	Mashpee
Mashpee River	Mashpee
Mill Creek	Sandwich
Scorton Creek	Sandwich
Pamet River	Truro

CHARLES RIVER BASIN

Charles River above Dilla Street	Milford-Hopkinton
Mine Brook above Franklin STP	Franklin
Sugar Brook above Millis STP	Millis
Godfrey Brook above Depot Street sewer overflow	Milford
Huckleberry Brook	Milford
Beaver Brook	Bellingham
Stall Brook	Bellingham
Hopping Brook	Medway
Chicken Brook	Medway
Shepards Brook	Franklin
Mill River	Norfolk
Stop River	Norfolk
Vine Brook	Medfield
Mill Brook	Medfield
Bogastow Brook	Millis
Jar Brook	Holliston

STREAM	MUNICIPALITY
Sewell Brook	Sherborn
Indian Brook	Sherborn
Davis Brook	Natick
Waban Brook	Wellesley
Fuller Brook	Wellesley
Bogle Brook	Wellesley
Trout Brook	Dover
Noanet Brook	Dover
Powissett Brook	Dover
Rock Meadow Brook	Dover
Sawmill Brook	Boston
South Meadow Brook	Newton
Rosemary Brook	Needham
Seaverns Brook	Weston
Stony Brook	Weston
Hobbs Brook	Weston
Beaver Brook	Waltham
Chester Brook	Waltham
Cheesecake Brook	Newton
All intermittent streams	---
All tributaries to the above streams	---

CHICOPEE RIVER BASIN

Abbey Brook	Chicopee
Cooley Brook	Chicopee
Fuller Brook	Chicopee
Higher Brook	Chicopee
Minechoag Brook	Ludlow
Harris Brook	Ludlow
Calkins Brook	Monson
Twelvemile Brook	Monson
Maxwell Brook	Monson
Thayer Brook	Monson
Cadwell Brook	Monson
Broad Brook	Ludlow
Jabbish Brook	Belchertown

STREAM	MUNICIPALITY
Axe Factory Brook	Belchertown
Roaring Brook	Belchertown
Cadwell Brook	Pelham
Chaffee Brook	Pelham
Gulf Brook	Pelham
Purgee Brook	Pelham
Briggs Brook	Pelham
Atherton Brook	Pelham
Osgood Brook	Shutesbury
Town Farm Brook	Shutesbury
Cobb Brook	Shutesbury
Camel Brook	Shutesbury
West Branch Swift River	New Salem
Rocky Run	Shutesbury
Thurston Brook	New Salem
Prescott Brook	New Salem
Egypt Brook	New Salem
Underhill Brook	New Salem
Hop Brook	New Salem
Giles Brook	New Salem
Moosehorn Brook	New Salem
Manning Brook	New Salem
Middle Branch Swift River	New Salem
Spriggy Brook	New Salem
West Branch Fever Brook	Petersham
East Branch Fever Brook	Petersham
East Branch Swift River	Petersham
Rutland Brook	Petersham
Moccasin Brook	Petersham
Lorinda Brook	Petersham
Swift River above Bondsville	Belchertown
Beaver Brook	Ware
Penny Brook	Ware
Flat Brook	Ware
King Brook	Ware
Muddy Brook	Ware
Canterbury Brook	Ware

STREAM	MUNICIPALITY
Newton Brook	Ware
Elwell Brook	Ware
Danforth Brook	Hardwick
Moose Brook	Hardwick
Winimusset Brook	New Braintree
Broadmeadow Brook	Hardwick
Pine Hill Brook	Hardwick
Pratt Brook	Barre
Burrow Brook	Barre
Prince River	Barre
Smith Brook	Barre
Galloway Brook	Barre
Dicks Brook	Barre
Pleasant Brook	Barre
Potash Brook	Barre
Burnshirt River	Barre
Steep Gutter Branch	Barre
Wine Brook	Phillipston
Canesto Brook	Hubbardston
Natty Pond Brook	Hubbardston
West Branch Ware River	Hubbardston
East Branch Ware River	Rutland
Stevens Branch	Barre
Longmeadow Brook	Rutland
Mill Brook	Rutland
Pommogusett Brook	Rutland
Joslin Brook	Hubbardston
West Wachusett Brook	Princeton
Mason Brook	Hubbardston
Chicopee Brook	Monson
Bottle Brook	Brimfield
Kings Brook	Palmer
Penny Brook	Brimfield
Turkey Brook	Brimfield
Blodgett Mill Brook	Brimfield
School Street Brook	Warren
O'Neil Brook	Warren

STREAM	MUNICIPALITY
Cheney Brook	Warren
Sullivan Brook	Warren
Lamberton Brook	Warren
Nattaug Brook	Warren
Mill Brook	West Brookfield
Meadow Brook	New Braintree
Sucker Brook	West Brookfield
Coys Brook	West Brookfield
Bun Brook	Brookfield
Salmon Brook	Brookfield
Willow Brook	Brookfield
Trout Brook	Brookfield
Dunn Brook above STP	North Brookfield
Forget-Me-Not Brook	North Brookfield
Great Brook	East Brookfield
Five Mile River	North Brookfield
Horse Pond Brook	North Brookfield
North Brook	North Brookfield
Cranberry River above STP	Spencer
Turkey Hill Brook	Spencer
Caruth Brook	Spencer
Shaw Brook	Spencer
Ware River above the confluence of the Prince River	Barre
All intermittent streams	---
All tributaries to above streams	---
CONNECTICUT RIVER BASIN	
Fall River	Gill
Mill River	Hatfield
Fort River	Amherst
Mill River	Northampton
Manhan River	Easthampton
Stony Brook	South Hadley
Scantic River	Hamden

STREAM	MUNICIPALITY
All intermittent streams	---
All tributaries to above streams	---
All tributaries, named or unnamed, to the Connecticut River with the exception of the Millers, Deerfield, Chicopee, and Westfield rivers and Bachelor Brook	

DEERFIELD RIVER BASIN

Fife Brook	Monroe
Cold River	Savoy
Chickley River	Hawley
Mill Brook	Charlemont
North River above Kendall Co. Treatment Plant	Colrain
Beaver River	Conway
Green River above Greenfield Sewage Treatment Plant	Greenfield
All intermittent streams	---
All tributaries to above streams	---
All other tributaries, names or unnamed, to the Deerfield River with the exception of the South River	---

FARMINGTON RIVER BASIN

All the streams within the Farmington River Basin including:	
West Branch of the Farmington River in its entirety	---
Fall River	Otis
Clam River	Sandisfield
Buck River	Sandisfield
Taylor Brook	Tolland
Hubbard Brook	Granville
Pond Brook	Granville
Valley Brook	Granville

FRENCH RIVER BASIN

STREAM	MUNICIPALITY
Grindstone Brook from its source to the outlet of Henshaw Pond	Leicester
Town Meadow Brook from its source to Leicester STP	Leicester
Burncoat Brook	Leicester
Bartons Brook	Leicester
Grindstone Brook	Leicester
Wellington Brook	Auburn/Oxford
Little River	Charlton/Oxford
Webster Lake and all of its tributaries	Webster/Oxford
Potash Brook	Dudley
Freemans Brook	Dudley
All other tributaries to the French River and the above-mentioned streams	

QUINEBAUG RIVER BASIN

Quinebaug River and all tributaries from its source to the Sturbridge STP:	
Hobbs Brook	Sturbridge
Breakneck Brook	Sturbridge
Hatchet Brook	Southbridge
Globe Brook	Charlton
McKinstry Brook	Southbridge
Cady Brook from its source to Charlton Woolen Co.	Charlton/Southbridge
Cohasse Brook	Southbridge
Lebanon Brook	Southbridge
Tufts Brook	Dudley
All other tributaries to the Quinebaug River and the above-mentioned streams.	---

HOOSIC RIVER BASIN

South Branch of the Hoosic River above Berkshire Machine Co.	Cheshire
North Branch of the Hoosic River in its entirety	Clarksburg North Adams
Green River above Springs Restaurant	New Ashford
All intermittent streams	---

STREAM	MUNICIPALITY
All tributaries to the above streams	---
All other tributaries, named or unnamed, to the Hoosic River	---

HOUSATONIC RIVER BASIN

East Branch of the Housatonic River above the Crane Paper Co. discharge	Dalton
West and Southwest Branches of the Housatonic River	Pittsfield
Goose Pond Stream above the Westfield Paper Co. discharge	Lee
Green River	Great Barrington
Konkapot River	New Marlborough
All intermittent streams	---
All tributaries to the above streams	---
All other named or unnamed tributaries to the Housatonic River with the exception of the Williams River and Hubbard Brook	---

IPSWICH RIVER BASIN

Maple Meadow Brook	Wilmington
Lubber Brook	Wilmington
Bear Meadow Brook	Reading
Martins Brook	North Reading
Wills Brook	Lynnfield
Norris Brook	Danvers
Outlet of Middleton Pond	Middleton
Emerson Brook	Middleton
Boston Brook	Middleton
Nichols Brook	Middleton
Fish Brook	Boxford
Mile Brook	Topsfield
Idlewild Brook	Hamilton
Howlett Brook	Topsfield
Gravelly Brook	Ipswich
Black Brook	Hamilton
Miles River	Hamilton

STREAM	MUNICIPALITY
Ipswich River above the Sylvania Dam	---
All intermittent streams	---
All tributaries to the above streams	---
PARKER RIVER BASIN	
Penn Brook	Georgetown
Beaver Brook	Groveland
Wheeler Brook	Georgetown
Mill River	Newbury
Little River	Newbury
Parker River and Parker River Estuary in their entirety	---
All intermittent streams	---
All tributaries to the above streams	---
THE ISLANDS	
All fresh waters in Duke County and Nantucket Basins	---
MERRIMACK RIVER BASIN	
Limit Brook	Tyngsborough
Locust Brook	Tyngsborough
Bridge Meadow Brook	Tyngsborough
Uptons Pond Brook	Tyngsborough
Lawrence Brook	Tyngsborough
Deep Brook	Chelmsford
Cold Spring Brook	Chelmsford
Black Brook	Lowell
Claypit Brook	Lowell
Scarlet Brook	Lowell
Peppermint Brook	Dracut
Nickel Mine Brook	Dracut
Richardson Brook	Dracut
Trout Brook	Dracut
Trull Brook	Tewksbury
Fish Brook	Andover
Bartlett Brook	Methuen
Griffin Brook	Methuen

STREAM	MUNICIPALITY
Bare Meadow Brook	Methuen
Creek Brook	Haverhill
Johnson Creek	Groveland
Goodwin Creek	Amesbury
Indian Run	West Newbury
Shawsheen River	
Beaver Brook	Bedford
Hussey Brook	Andover
Heath Brook	Tewksbury
Jones Brook	Billerica
Long Meadow Brook	Burlington
McKee Brook	Billerica
Meadow Brook	Tewksbury
Rogers Brook	Andover
Sandy Brook	Burlington
Webb Brook	Billerica
All named and unnamed tributaries to the above-named streams	---
All intermittent streams	---
MILLERS RIVER BASIN	
Millers River above Winchendon STP	Winchendon
Priest Brook	Royalston
Otter River above Gardner STP	Templeton
Beaver Brook above Fernald State School STP	Templeton
Tully River	Athol
Mill Brook	Athol
Orcutt Brook	Orange
All intermittent streams	---
All tributaries to above streams	---
All other named or unnamed tributaries to the Millers River	---

NASHUA RIVER BASIN

STREAM	MUNICIPALITY
Unkety Brook	Dunstable
Reedy Meadow Brook	Pepperell
Nissitissit River	Pepperell
Greens Brook	Pepperell
Nod Brook	Groton
Robinson Brook	Pepperell
Wrangling Brook	Groton
James Brook	Groton
Squannacook River upstream of Hollingsworth and Vose Dam	Townsend
Mulpus Brook	Shirley
Walker Brook	Shirley
Trout Brook	Shirley
Catacoonamaug Brook	Shirley
Still River	Bolton
Runaway Brook	Bolton
Counterpane Brook	Clinton
Ponakin Brook	Lancaster
Spectacle Brook	Lancaster
McGovern Brook	Lancaster
Wekepeke Brook	Lancaster
White Pond Brook	Leominster
Fall Brook	Leominster
Monoosnoc Brook	Leominster
Baker Brook	Fitchburg
Phillips Brook	Fitchburg
Whitman River	Fitchburg
Flagg Brook	Fitchburg

The Nashua River and its North and South Branches and the Squannacook River below the Hollingsworth and Vose Dam are the only streams in the Nashua River Basin which have been designated to receive treated wastewaters. In addition to the streams listed above, all other named and unnamed streams in the Nashua River Basin are to be designated anti-degradation.

NORTH COASTAL BASIN

STREAM	MUNICIPALITY
Essex River above proposed municipal STP	Essex
Saugus River above Summer St. overflow	Saugus-Lynn
Pines River	Saugus
Forest River	Salem
North River	Salem
Waters River	Salem
Porters River	Salem
Danvers River	Salem
Little Creek	Gloucester
Walker Creek	Gloucester
All intermittent streams	---
All other named or unnamed fresh water streams in North Coastal Basin	---

NORTH RIVER BASIN

First Herring Brook	Scituate
Herring River	Scituate
Second Herring Brook	Norwell
Stony Brook	Norwell
Hannah Eames Brook	Marshfield
Bares Brook	Marshfield
Littles Creek	Marshfield
Cove Brook	Marshfield
South River	Marshfield
Third Herring Brook	Hanover
Longwater Brook	Hanover
Ben Mann Brook	Hanover
Torrey Brook	Hanover
Iron Mile Brook	Hanover
Rocky Run	Hanover
Herring Brook	Pembroke
Robinson Creek	Pembroke
Cushing Brook	Rockland

STREAM	MUNICIPALITY
Indian Head Brook	Hanson
All named and unnamed tributaries to the above-mentioned streams	---
All other named and unnamed streams in the North River Basin other than French Stream, the Drinkwater River, the Indian Head River, and the North River	---
All intermittent streams	---

SOUTH COASTAL BASIN

Jones River	Kingston
Jones River Estuary	Kingston
Back River	Duxbury
Bluefish River	Duxburh
Green Harbor River	Marshfield
West Brook	Duxbury
Town Brook	Plymouth
Eel River	Plymouth
Beaver Dam Brook	Plymouth
Indian Brook	Plymouth
All other named or unnamed streams in the South Coastal Drainage Basin	---
All intermittent streams	---

SUASCO RIVER BASIN

Sudbury River Basin

Sudbury River above confluence with Wash Brook	Wayland
Cowassock Brook	Ashland
Willow Brook	Ashland
Snake Brook	Cochituate
Baiting Brook	Framingham
Birch Meadow Brook	Framingham
Dunsdell Brook	Framingham
Eames Brook	Framingham
Cold Spring Brook	Hopkinton
Indian Brook	Hopkinton
Whitehall Brook	Hopkinton
Mowry Brook	Marlborough

STREAM	MUNICIPALITY
North Branch Mowry Brook	Marlborough
Course Brook	Sherborn
Angelica Brook	Southborough
Stony Brook	Southborough
Bridge Brook	Sudbury
Cold Brook	Sudbury
Dudley Brook	Sudbury
Dugan Brook	Sudbury
Pantry Brook	Sudbury
Run Brook	Sudbury
Hayward Brook	Wayland
Hazel Brook	Wayland
Pine Brook	Wayland
Denny Brook	Westborough
Jackstram Brook	Westborough
Piccadily Brook	Westborough
Rutgers Brook	Westborough

Assabet River Basin

Assabet River above Westborough STP	Westborough
Nagog Brook	Acton
Gates Pond Brook	Berlin
Hog Brook	Berlin
North Brook	Berlin
Great Brook	Bolton
Elizabeth Brook	Boxborough
Fort Pond Brook	Boxborough
Guggins Brook	Boxborough
Heath Hen Meadow Brook	Boxborough
Dakins Brook	Concord
Spencer Brook	Concord
Dansforth Brook	Hudson
Fort Meadow Brook	Hudson
Butter Brook	Littleton
Nashoba Brook	Littleton

STREAM	MUNICIPALITY
Nonset Brook	Littleton
Vine Brook	Littleton
Millham Brook	Marlborough
North Branch Brook	Marlborough
Second Division Brook	Maynard
Taylor Brook	Maynard
Barefoot Brook	Northborough
Cold Harbor Brook	Northborough
Howard Brook	Northborough
Rawson Hill Brook	Northborough
Stirrup Brook	Northborough
Assabet River	Stow
Hop Brook	Westborough
Little Bummit Brook	Westborough

Concord River Basin

Mill Brook	Bedford
Pages Brook	Carlisle
Beaver Brook	Chelmsford
Farley Brook	Chelmsford
Pond Brook	Chelmsford
Putnam Brook	Chelmsford
River Meadow Brook	Chelmsford
Mill Brook	Concord
Back Brook	Lowell
Marginal Brook	Tewksbury
All intermittent streams	---
All tributaries to the above-named streams	---

TAUNTON RIVER BASIN

Matfield River

Lovett Brook	Brockton
Trout Brook	Brockton
Edison Brook	Brockton
Salisbury Brook	Brockton
Salisbury Plain River above STP	Brockton
Satucket River	East Bridgewater

STREAM	MUNICIPALITY
Shumatuscacant River	Whitman
Town River	
Coweset Brook	West Bridgewater
Queset Brook	West Bridgewater
West Meadow Brook	West Bridgewater
Town River above Bridgewater STP	Bridgewater
South Brook	Bridgewater
Taunton River	
Winnetuxet River	Halifax
Poguoy Brook	Middleborough
Cotely River	Taunton
Nemasket River above Middleborough STP	Middleborough
Mill River above Whittenton Street	Taunton
Canoe River	Norton
Snake River	Taunton
Segreganset River	Dighton
Muddy River above ICI America	Dighton
Assonet River	Freetown
Labor in Vain Brook	Somerset
North Watuppa Pond	Fall River
South Watuppa Pond	Fall River
Lee River	Swansea-Somerset
Cole River	Swansea
Threemile River	
Chartley Brook	Norton
Wading River above Barrowsville Pond	Norton
Rumford River above Mansfield STP	Norton
All intermittent streams	---
All tributaries to above-named streams	---
TEN MILE RIVER BASIN	
Seven Mill River	Attleboro
Coles Brook	Seekonk
Four Mile Brook	Attleboro
Scotts Brook	North Attleborough
Ten Mile River above Plainville	---

STREAM	MUNICIPALITY
All named and unnamed tributaries to the above-mentioned streams	---
All intermittent streams	---
WESTFIELD RIVER BASIN	
East Branch above confluence with West Branch	Huntington
Pond Brook	Huntington
Sykes Brook	Huntington
Little River	Huntington
Dead Branch	Huntington
Chauncy Brook	Chesterfield
Holly Brook	Chesterfield
Bronson Brook	Worthington
Center Brook	Savoy
Childs Brook	Cummington
Meadow Brook	Cummington
Mill Brook	Plainfield
West Branch Brook	Chesterfield
Westfield Brook	Windsor
Windsor Jams Brook	Windsor
Middle Branch above confluence with East Branch	Huntington
Winchell Brook	Chester
Day Brook	Chester
Moss Meadow Brook	Chester
Kinney Brook	Chester
Skunk Brook	Chester
Watts Stream	Worthington
Birch Meadow Brook	Blandford
Richards Brook	Blandford
Phelon Brook	Blandford
Falls Brook	Blandford
Borden Brook	Blandford
Middle Brook	Blandford
Tannery Brook	Blandford
Bedlam Brook	Blandford

STREAM	MUNICIPALITY
Tiffany Brook	Blandford
Pebble Brook	Blandford
Wheeler Brook	Blandford
Pixley Brook	Blandford
Watson Brook	Blandford
Pond Brook	Blandford
Ripley Brook	Blandford
Henry Brook	Blandford
Lloyd Brook	Blandford
Freeland Brook	Blandford
Nye Brook	Blandford
Block Brook	West Springfield
White Brook	Agawam
Miller Brook	Agawam
Paucutuck Brook	West Springfield
Barry Brook	Westfield
Bush Brook	Westfield
Trash Brook	Westfield
Sandy Mill Brook	Westfield
Powdermill Brook	Westfield
Great Brook	Westfield
Arm Brook	Westfield
Kellog Brook	Southwick
Slab Brook	Southwick
Johnson Brook	Southwick
Pearl Brook	Southwick
Mountain Brook	Southwick
Palmer Brook	Southwick
Tuttle Brook	Southwick
Jacks Brook	Westfield
Shurtleff Brook	Southwick
Munn Brook	Granville
Dickenson Brook	Granville
Seymor Brook	Granville
Japhet Brook	Granville

STREAM	MUNICIPALITY
Tillotseon Brook	Granville
Hollister Brook	Granville
White Brook	Granville
Jim Brook	Westfield
Walker Brook	Westfield
Drake Brook	Granville
Trumble Brook	Granville
Jackson Brook	Worthington
Glendale Brook	Middlefield
Smith Brook	Chester
Fuller Brook	Peru
Trout Brook	Peru
West Branch above Town of Chester	Middlefield
Roaring Brook	Huntington
Cold Brook	Huntington
Cook Brook	Chester
Goldmine Brook	Chester
Griffin Brook	Chester
Sanderson Brook	Chester
Blair Brook	Chester
Abbott Brook	Chester
Austin Brook	Chester
Otis Wait Brook	Chester
Walker Brook	Chester
Depot Brook	Washington
Factory Brook	Middlefield
Shaker Hill Brook	Becket
Yokum Brook	Becket
Westfield Little River above Cobble Mountain Reservoir outlet	Blandford
Potash Brook	Blandford
Cooks Brook	Westfield
Pitcher Brook	Russell
Moose Meadow Brook	Westfield
Shatterrack Brook	Russell

STREAM	MUNICIPALITY
Wigwam Brook	Russell
Sage Brook	Russell
Black Brook	Russell
Gibbs Brook	Blandford
Freeland Brook	Blandford
Bearden Brook	Montgomery
Pond Brook	Russell
Crow Brook	Huntington
Horse Hill Brook	Huntington
Watts Stream	Worthington
Wards Stream	Worthington
Whiteside Brook	Chesterfield
Steven Brook	Worthington
Whitmarsh Brook	Worthington
Kearney Brook	Worthington
Alder Meadow Brook	Cummington
Page Brook	Chesterfield
Rocky Brook	Chesterfield
East Brook	Goshen
Swift River	Goshen
North Branch, Swift River	Goshen

APPENDIX III

WATER QUALITY INDEX

HOUSATONIC RIVER BASIN

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
			EAST BRANCH		
HS01	69.0	8/77			83.6
HS02	66.5	8/77			93.5
HS03	63.7	8/77			89.2
HS04	62.9	8/77			86.4
HS05	61.0	8/77			90.3
HS06	60.5	8/77	BOD**	23	73.8
HS07	59.7	8/77	BOD* DO*	41 38	72.0
HS07A	58.9	8/77	BOD* TS DO**	26 59 11	52.8
HS08	57.4	8/77	FEC BOD* DO**	58 36 20	58.9
HS09	56.8	8/77	FEC BOD* TS DO**	54 40 63 12	54.0
HS09A	56.4	8/77	FEC BOD* DO*	58 49 25	63.3
HS10	55.7	8/77	FEC BOD* TS DO*	58 49 62 28	63.5
			MAIN STEM		
HS11	54.7	8/77	FEC DO*	56 45	71.7
HS12	49.5	8/77	FEC* P* DO*	41 47 45	64.8
HS13	46.5	8/77	FEC* P* TS DO*	27 48 64 49	61.9
HS14	45.1	8/77	FEC BOD P TS	60 60 60 64	75.8
HS15	43.8	8/77	FEC BOD P	58 64 59	76.7
HS16	42.9	8/77	FEC P	61 57	76.5
HS16A	41.4	8/77	FEC BOD P TS	58 62 63 64	76.6
HS17	40.0	8/77	FEC	58	76.4
HS17A	36.5	8/77	BOD	64	76.9
HS18	35.5	8/77	DO	60	75.6
HS19	28.9	8/77	FEC	60	78.5
HS19A	26.0	8/77	FEC TS	58 64	79.1
HS20	25.7	8/77	FEC TS	64 62	79.0
HS21	24.7	8/77	BOD TS	64 63	80.9
HS22	23.9	8/77	BOD	62	80.4
HS23	19.3	8/77			80.2
HS24	17.1	8/77	FEC	62	78.4
HS24A	13.9	8/77	FEC BOD	57 64	78.1

WATER QUALITY INDEX (CONTINUED)

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
HS25	11.4	8/77	FEC BOD TS	60 57 62	77.2
HS26	9.0	8/77	BOD	64	80.8
HS27	2.0	8/77	BOD	60	84.3
			NASHUA RIVER BASIN		
			NORTH BRANCH		
NN01	56.4	8/77			86.1
NN02	55.9	8/77	BOD**	2	55.4
NN03	55.5	8/77	BOD** DO**	9 13	48.3
NN04	54.7	8/77	BOD** DO*	21 29	62.0
NN05	53.8	8/77	FEC** BOD* DO	23 38 52	59.1
NN06	53.1	8/77	FEC* BOD* DO	28 46 63	64.1
NN07	52.4	8/77	FEC** BOD	22 54	65.3
NN08	50.8	8/77	FEC** BOD	22 52	65.0
NN09	50.2	8/77	FEC** BOD	22 53	64.8
NN10	47.8	8/77			81.6
NN11	45.8	8/77	BOD** P* DO	21 38 64	64.6
NN12	43.8	8/77	BOD* P* DO	32 41 64	65.2
NN13	39.8	8/77	BOD* P* DO	39 48 59	70.4
NN14	36.8	8/77	BOD* P DO	43 50 62	70.1
			SOUTH BRANCH		
NS15	4.6	8/77			92.4
NS16	3.5	8/77			82.8
NS17	1.6	8/77	FEC	63	79.1
NS18	1.1	8/77	FEC** BOD* P* DO	12 49 38 64	52.1
NS19	0.3	8/77	FEC** BOD P* DO	13 54 39 51	52.7
			MAINSTEM		
NM20	35.0	8/77	FEC* BOD P* DO	30 52 48 52	60.0
NM21	31.0	8/77	FEC BOD P DO	53 62 50 52	67.7
NM22	26.9	8/77	FEC P DO	64 52 53	71.7
NM23	25.9	8/77	P DO	59 56	73.0
NM24	24.3	8/77	P	60	78.7
NM25	23.1	8/77	FEC* P	39 62	71.0
NM26	20.6	8/77	FEC	50	75.8

WATER QUALITY INDEX (CONTINUED)

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
NM27	17.7	8/77	FEC	64	79.3
NM28	14.2	8/77	BOD*	44	81.0
NM29	13.8	8/77	BOD	52	81.8
NM30	9.6	8/77	BOD	60	82.3
			BLACKSTONE RIVER BASIN		
			KETTLE BROOK		
BS01	59.3	8/77			91.1
BS02	58.2	8/77	FEC* BOD* P** TURB TS** DO*	42 44 16 58 20 31	46.1
BS03	57.4	8/77	FEC BOD* P* TURB TS** DO	55 49 35 62 20 40	55.0
BS04	55.9	8/77	FEC* BOD P* TS*	26 56 49 36	61.7
BS05	55.0	8/77	BOD DO*	52 50	72.2
BS06	53.5	8/77			79.0
BS07	52.7	8/77	BOD	57	84.1
BS08	51.3	8/77	FEC* BOD	27 53	68.5
			BLACKSTONE RIVER		
BS09A	48.6	8/77	FEC* BOD	39 55	73.3
BS09	47.9	8/77	FEC** BOD** P* TURB TS DO**	2 9 39 57 60 19	25.9
BS10	46.0	8/77	FEC** BOD* P* DO*	2 34 36 40	34.3
BS11	43.6	8/77	FEC** BOD* P*	2 43 36	38.7
BS12	42.2	8/77	FEC* BOD** P* DO*	43 17 36 39	51.9
BS13A	40.6	8/77	FEC** BOD* P*	21 41 38	57.3
BS13	39.7	8/77	FEC** BOD** P*	20 23 39	54.3
BS14	36.8	8/77	FEC* BOD* P* DO**	47 26 41 17	48.5
BS15	35.0	8/77	FEC* BOD* P* DO**	45 41 46 16	50.6
BS16	31.3	8/77	FEC* BOD P* DO**	47 62 49 20	55.6
BS17A	30.0	8/77	FEC BOD P	54 52 50	67.7
BS17	27.9	8/77	FEC* BOD P DO	41 60 55 61	66.2
BS18	23.7	8/77	FEC P	51 64	73.5
BS19	21.0	8/77	FEC BOD	64 64	79.8
BS20	20.0	8/77	FEC	58	78.9
BS21	17.2	8/77	FEC BOD TS	50 62 51	75.3

WATER QUALITY INDEX (CONTINUED)

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
			MUMFORD RIVER		
MF01	12.9	8/77			87.4
MF02	11.0	8/77			87.5
MF03	9.2	8/77	FEC	63	84.2
MF04A	8.5	8/77			88.2
MF04	7.5	8/77	FEC BOD	63 52	76.1
MF05	5.9	8/77	BOD* DO*	37 50	73.3
MF06A	4.5	8/77	FEC BOD	59 57	82.0
MF06	2.5	8/77	FEC BOD	60 60	80.2
MF07A	.7	8/77	BOD	61	84.4
MF07	.2	8/77	FEC* BOD	46 52	75.0
			WEST RIVER		
WR00	12.0	8/77			82.0
WR01	9.7	8/77	FEC	50	75.9
WR02	8.3	8/77	FEC BOD DO	52 60 61	72.4
WR03A	5.6	6/77			86.7
WR03	4.2	6/77			86.9
WR04	1.6	8/77	DO	56	80.6
WR05	.5	8/77	FEC	59	80.3
			IPSWICH RIVER BASIN		
			IPSWICH RIVER		
IP01	37.4	7/05/77	DO**	8	59.6
IP02	36.4	7/05/77	DO**	21	68.2
IP03	32.1	7/05/77	DO	60	82.3
IP04	28.5	7/05/77	DO*	26	70.6
IP05	23.3	7/05/77	DO*	49	80.6
IP06	16.6	7/05/77	DO	51	79.9
IP07	9.4	7/05/77	DO*	25	69.3
IP08	4.5	7/05/77			85.1
			LUBBER BROOK		
IP09	36.6	7/05/77	DO*	27	73.3
			MARTINS BROOK		
IP10	33.2	7/05/77	DO**	18	66.6

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
			BOSTON BROOK		
IP11	21.7	7/05/77			88.5
			FISH BROOK		
IP12	19.1	7/05/77	FEC	64	83.2
			HOWLETT BROOK		
IP13	10.5	7/05/77			87.6
			MILES RIVER		
IP14	6.1	7/05/77	DO**	24	69.4
IP15		7/05/77	DO**	3	49.9
IP16		7/05/77	DO**	9	59.6
			ABERJONA RIVER BASIN		
			ABERJONA RIVER		
AB17		7/05/77	FEC TS	62 52	78.5
AB18		7/05/77	FEC* TS DO	47 53 60	71.6
AB19		7/05/77	FEC TS*	62 48	77.6
			HORN POND BROOK		
AB20		7/05/77			84.8
			SWEETWATER BROOK		
AB21		7/05/77	FEC** BOD** P* TS DO**	17 2 28 57 18	30.0
			HALL'S BROOK		
AB22		7/05/77	DO*	39	71.9
			NEPONSET RIVER BASIN		
			NEPONSET RIVER		
NE23		7/06/77	FEC BO O*	58 55 49	71.0
NE24		7/06/77			87.0
NE24A		7/06/77	FEC	53	79.8
NE25		7/06/77	FEC	54	79.7
NE26		7/06/77			87.4
NE27		7/06/77	FEC*	32	75.7
NE28		7/06/77	FEC*	30	73.2
			SCHOOL MEADOW BROOK		
NE29		7/06/77	DO*	29	71.6
			HAWES BROOK		
NE30		7/06/77	FEC	58	84.3

WATER QUALITY INDEX (CONTINUED)

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
			TRAPHOLE BROOK		
NE31		7/06/77	FEC TS	62 64	83.9
			MASSAPOAG BROOK		
NE32		7/06/77	FEC	50	82.3
			PURGATORY BROOK		
NE33		7/06/77	FEC* TS**	45 20	72.6
			PLANTINGFIELD BROOK		
NE33A		7/06/77	FEC	55	81.5
			PONKAPOAG BROOK		
NE34		7/06/77			82.7
			PINE TREE BROOK		
NE35		7/06/77	FEC*	32	77.3
			NORTH AND SOUTH RIVER BASIN		
			DRINKWATER RIVER		
NS36		7/07/77			83.4
			FRENCH STREAM		
NS37		7/07/77	FEC	58	82.9
			DRINKWATER RIVER		
NS38		7/07/77	DO	62	78.4
			INDIAN HEAD RIVER		
NS39		7/07/77	P DO	51 55	75.8
NS40		7/07/77	FEC DO	54 54	72.1
			SOUTH RIVER		
NS41		7/07/77	FEC	53	83.6
			THIRD HERRING BROOK		
NS42		7/07/77	TS	64	80.5
			SECOND HERRING BROOK		
NS43		7/07/77	FEC	54	80.4
			FIRST HERRING BROOK		
NS44		7/07/77	FEC	54	76.2
			TORREY BROOK		
NS45		7/07/77	FEC	60	82.3
			IRON MINE BROOK		
NS46		7/07/77	FEC TS	64 64	84.2
			INDIAN HEAD BROOK		
NS47		7/07/77			82.6

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
			FURNACE BROOK		
NS48		7/07/77			86.5
			LITTLES CREEK		
NS49		7/07/77			87.5
			H. EAMES BROOK		
NS50		7/07/77			90.7
			CHARLES RIVER BASIN		
			CHARLES RIVER		
CH51	69.8	7/05/77	BOD P* DO**	60 28 13	53.8
CH52	60.1	7/05/77	P*	39	78.6
CH53	54.5	7/05/77	P	64	84.4
CH54	41.1	7/05/77	P*	47	80.3
CH55	32.6	7/05/77	FEC	64	79.4
CH56	26.8	7/05/77	BOD	57	84.2
CH57	20.3	7/05/77	BOD* DO*	37 50	73.9
CH58	18.3	7/05/77	BOD	50	81.6
CH59	12.7	7/05/77			85.3
			HOPPING BROOK		
CH60	64.0	7/05/77	FEC	58	80.3
			MINE BROOK		
CH61	63.1	7/05/77	P* DO**	38 16	57.1
			CHICKEN BROOK		
CH62	62.9	7/05/77	BOD DO	62 56	76.1
			SHEPARDS BROOK		
CH63	60.6	7/05/77	FEC DO*	64 44	73.0
			MILL RIVER		
CH64	57.6	7/05/77			91.8
			STOP RIVER		
CH65	51.8	7/05/77	DO**	17	65.9
			BOGASTOW BROOK		
CH66	48.3	7/05/77	DO	61	79.8
			WABAN BROOK		
CH67	31.2	7/05/77	FEC	62	84.2
			FULLER BROOK		
CH68		7/05/77	FEC*	50	79.2

WATER QUALITY INDEX (CONTINUED)

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
			POWISSETT BROOK		
CH69	31.5	7/05/77			87.4
			ROSEMARY BROOK		
CH70	19.1	7/05/77	TS	57	82.7
			STONY BROOK		
CH71	15.5	7/05/77			91.2
CH72		7/05/77	TS	59	81.8
			HOBBS BROOK		
CH73		7/05/77	TS	63	81.8
			BEAVER BROOK		
CH74	12.2	7/05/77	FEC*	30	70.2
			SUASCO RIVER BASIN		
			SUDBURY RIVER		
SU75	40.7	7/06/77	FEC* DO*	46 49	71.7
SU76	38.9	7/06/77	FEC* DO	28 62	69.8
SU77	36.1	7/06/77	FEC	58	83.5
SU78	31.6	5/03/77	BOD	57	85.4
SU79	26.6	7/06/77	FEC* BOD	41 64	77.7
SU80	26.1	7/06/77	FEC	51	79.6
SU81	20.0	7/06/77	FEC BOD*	56 47	76.5
SU82	15.7	7/06/77	FEC BOD	54 55	80.5
			INDIAN BROOK		
SU83		7/06/77			83.7
			COLD SPRING BROOK		
SU84		7/06/77	DO	50	79.4
			DUNSDELL BROOK		
SU85		7/06/77	FEC* DO	41 53	73.6
			HOP BROOK		
SU86		7/06/77	FEC* BOD TURB	42 54 64	71.6
SU87		7/06/77	FEC BOD* TURB	64 47 60	74.7
			ASSABET RIVER		
SU88	19.6	7/06/77	FEC P*	61 48	79.7
SU89	16.2	7/06/77	FEC* BOD* P*	39 36 46	64.3
SU90	14.4	7/06/77	FEC* BOD P* DO*	44 57 46 25	58.4

WATER QUALITY INDEX (CONTINUED)

STATION	RIVER MILE	SAMPLING DATE	PARAMETERS VIOLATED	QUALITY RATING	WQI
SU91	9.0	7/06/77	FEC P	53 57	79.2
SU92	7.7	7/06/77	BOD P	57 53	79.1
SU93	6.5	7/06/77	FEC BOD P* DO	53 55 44 64	69.7
SU94	4.6	7/06/77	FEC* P*	47 48	73.6
SU95		7/06/77	FEC	50	80.3
			CONCORD RIVER		
SU96		7/06/77	FEC BOD	51 64	78.4
			DANSFORTH BROOK		
SU97		7/06/77	FEC	53	80.0
			FORT MEADOW BROOK		
SU98		7/06/77	FEC	56	81.1
			ELIZABETH BROOK		
SU99		7/06/77	FEC*	50	79.2
			FORT POND BROOK		
SU100		7/06/77	FEC*	47	78.5
			NASHOBA BROOK		
SU101		7/06/77	FEC DO	60 64	79.8
			WARNER'S POND		
SU102		7/06/77	FEC BOD	54 64	82.0
			SPENCER BROOK		
SU103		7/06/77	FEC* DO	46 50	72.2
			DAKINS BROOK		
SU104		7/06/77	FEC DO*	58 40	72.2
			FORT POND BROOK		
SU105		7/06/77	FEC* DO	44 58	73.1
			NAGOG BROOK		
SU106		7/06/77	FEC	55	81.9

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